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HANDBOOK
OF THE
B.L. 60-PR.
MARKS I. TO I GUNS**
ON
Marks I and III Field Carriages.

LAND SERVICE.

1921.



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HANDBOOK

OF THE

B.L. 60-PR. AND 60-PR. A AND B GUNS, MARKS I TO I**.

GUN.

Material	Steel (wire construction)
Weight	...	...	...	...	39-cwts.
Length, total	...	...	...	...	168·05-inches
Bore	{	calibre	...	...	5-inches
		length	...	...	160-inches=32-calibres
Chamber	{	diameter	...	{ largest	6-inches
			...	{ smallest	5·3-inches
	{	length	...	...	21·926-inches
		capacity	...	...	618·75-cubic inches
Rifling	{	system	...	...	Polygroove, modified plain section
		length	...	...	135·968-inches
	{	twist	...	...	Uniform 1-turn in 30-calibres
		grooves	...	{ number	24
				{ width	0·436-inch
				{ depth	0·05-inch
Obturation	...	...	...	...	Pad
Venting	...	...	...	...	Axial
Firing mechanism	...	...	...	...	" Lock, Percussion, 'P.H.' " and " Box, Slide, 'V.' "
Position of centre of gravity	{	with mechanism	...	...	57·5-inches from face of breech
		without "	...	...	59·7 " " " "

GUN BODY, MARK I.

(Plate I.)

The gun body is made of steel and consists of tubes, a series of layers of steel wire, jacket and breech ring. The A tube is lined with "an inner A" tube extending from the seat of the obturator to the muzzle and secured longitudinally by means of corresponding shoulders and a breech bush which is screwed into the A tube at the rear; the breech bush is also prepared for the reception of the breech screw. Over the rear of the A tube are wound successive layers of steel wire, the ends of which are secured to steel rings.

The jacket is fitted over the exterior of the wire and a portion of the A tube and is secured longitudinally by corresponding shoulders and the breech ring which is fitted over the rear end of the A tube and screwed to the jacket.

The breech bush and breech ring are prevented from turning when in position by means of fixing screws.

The breech ring is prepared for the reception of the breech mechanism and is provided on the upper side with lugs for the attachment of the hydraulic buffer and running out springs of the carriage. Guns of future manufacture will have a steel guide plate for shot guide lever attached to the rear face of the breech ring by means of a dovetail and two screwed rivets in place of the solid bracket for supporting the shot guide lever.

The guns are marked on the left guide rib with a scale of inches to indicate the amount of recoil. The markings are from 45 to 60, with a brass strip across the outer face of the guide rib at 57 inches indicating safe limit of recoil.

Longitudinal projections on each side of the jacket form guides for the gun when in the cradle of the carriage.

The chamber is cylindrical, coned to the front and to the rear.

Vertical and horizontal axis lines are cut on the gun at the muzzle and breech.

Planes for clinometer are prepared on the upper surface of the longitudinal projections on the jacket at the front.

GUN BODY, MARK I*.

The Mark I* gun body differs from Mark I in having a thicker "A" tube; but is without "inner A" tube and breech bush, the rear end of the "A" tube being prepared for the reception of the breech screw.

Worn guns on repair will be fitted with "inner A" tube and breech bush generally similar to Mark I guns.

GUN BODY, MARK I**.

The Mark I** gun body differs from Mark I in having a thicker "A" tube, but is without "inner A" tube.

Worn guns on repair will be fitted with "inner A" tube generally similar to Mark I guns.

BREECH MECHANISM.

B.L., 60-pr. "A" and "B."

(Plates II and III.)

The breech mechanism is so arranged that by one pull on a lever the breech screw is unlocked and the screw and carrier swung into the loading position. After loading, one thrust on the same lever inserts the breech screw into the breech opening, and turns it into the locked position.

BREECH-CLOSING MECHANISM.

The breech is closed by a parallel steel screw having four portions of the thread removed longitudinally, each one-eighth of the circumference. The interior of the gun at the breech being prepared in a similar manner admits of the screw, when the raised portions are placed opposite the smooth surfaces in the gun, being pushed home and locked by the eighth of a turn.

A carrier for supporting the breech screw, when withdrawn from the gun, is hinged by a bolt and bronze bush to the right side of the gun at the breech, the bolt and bush being arranged to admit of lateral movement of the carrier hinge joint in opening and closing the breech. The breech screw is attached to the carrier by means of interrupted screw threads on the carrier and interior of breech screw. A steel axial vent passes through the centre of the breech screw; it

has a mushroom head at the inner end, between which and the front face of the breech screw are placed the obturating pad and discs. The vent is retained by the sleeve and nut. The carrier is furnished with a breech mechanism lever, sliding block and actuating link, by means of which the breech screw is worked.

A catch, fitted to the carrier, engages with a recess in the rear face of the breech screw when the breech is open and retains the screw in the unlocked position. The catch is automatically disengaged from the screw when closing the breech.

The breech mechanism lever is retained in the closed position by means of a steel plunger working in a guide bracket, which is riveted to the underside of the breech mechanism lever. The upper end of the plunger projects through a hole in the lever and engages a recess in the carrier when the breech is closed and the breech mechanism lever home. The plunger is actuated by a pivoted lever and spring in the handle of the breech mechanism lever.

SHOT GUIDE.

A bronze guide block, to facilitate loading, is hinged by a hinge screw to the under side of the breech and is automatically raised to the loading position by means of a lever which engages with a cam groove on the under side of the carrier hinge joint when the breech is opened.

FIRING MECHANISM.

"P.H." Percussion Lock and "V" Slide Box.

(Plates IV and V.)

The firing mechanism with "P.H." percussion lock, and "V" slide box, consists of an axial vent bolt prepared for the reception of a vent bush spindle. The outer end of the vent bush spindle is chambered to suit the "Tube, percussion, S.A. cartridge," and is prepared on the exterior with a screw thread for the reception of the "V" slide box. Such axial vents are described as Mark IV; and axial vents Marks III, II*, and I****, when converted for use with these slide boxes and locks and vent bush spindle, are described as Marks III*, II**, and I***** respectively.

In later manufacture the axial vent bolt described as Mark V is prepared with a tube chamber in the outer end to suit the "Tube, percussion, S.A. cartridge," and existing axial vents are converted, as required, by having the hole for the vent bush spindle bushed with a steel plug having a fire channel prepared through its longitudinal axis where necessary and furnished at the outer end with a No. 4 vent head. The No. 4 vent head is of steel with a copper washer and is screwed into the rear end of the axial vent bolt, having its outer end chambered to suit the "Tube, percussion, S.A. cartridge," and prepared on the exterior with a screw thread for the reception of the "V" slide box. The vent head is secured in position by a set screw, the copper washer being adjusted until the holes prepared in the vent bolt and vent head for the reception of the set screw are in alignment.

On conversion or repair with a No. 4 vent head the axial vents are described as Mark V*, IV*, III**, II***, I***** and I***** respectively.

A certain number of vents of early patterns for B.L. 60-pr. "A" and "B" Marks I to I** guns which have not been prepared for the reception of the vent bush spindle, will, on conversion with No. 4 vent head, be distinguished by the addition of the letter S to the existing Mark and will be described as Marks II^s, I***^s, I**^s, I*^s and I^s, respectively.

The "Box, slide, 'V'" consists of a steel body screwed internally to suit the outer end of the vent bush spindle and prepared for the reception of the "P.H." percussion lock. In the interior of the slide box is pivoted an extractor lever, the inner end of which engages the percussion tube in the vent and has a lug on the outer end, by means of which it is actuated in working the lock. A steel stop plate for the actuating lever catch of the lock is provided on the exterior and secured by two screwed rivets. The slide box is prevented from turning when in position by a securing screw.

The "Lock, percussion, 'P.H.'" consists of a steel frame with firing hole bush and furnished with a striker, striker nut, cap, main spring collar, rebound collar and main spring. The lock slides vertically in the slide box and is worked by means of an actuating lever with retaining catch plunger and spring, pivoted on the exterior of the frame. The striker is withdrawn and the main spring compressed by a steel wedge fork on the No. 33 firing lanyard, which engages the underside of the striker cap when placed in position and is released in firing by pulling the lanyard clear of the lock.

OBTURATION.

Obturation is obtained by means of a mushroom-headed axial vent of steel passing through the centre of the breech screw, with a pad and a pair of copper discs. The inner face of the breech screw is flat, and between it and the head of the vent the pad and discs are arranged. The pad is made of asbestos worked up with mutton suet to a proper consistency and enclosed in a strong canvas cover; it is reduced to shape and pressed in a hydraulic machine.

The protecting discs are of copper and are arranged to fit the front and rear of the pad respectively. The outer circumferences of the front and rear discs are protected by a steel ring and the rear disc is also bushed with a bronze ring. The protecting discs are stamped with the words "Front" and "Rear," respectively, and the pads have the words "Front" stencilled on the side which corresponds with the front disc, and "Rear" on that which corresponds with the rear disc, in order that they may be correctly assembled on the vent. If correctly assembled the whole should fit together compactly.

Thin discs of steel are used to adjust the required thickness of the obturator.

The obturation is of the slow coned type.

Action.—When the breech screw is pushed into the gun the obturator enters the chamber with ease; on turning the breech screw the pad is pressed home into the coned seat in the gun by the travel

of the screw. The bore is thus closed by the pad which is in contact with the bore all round its circumference, while the mushroom head of the axial vent receives the force of the gas on discharge. On firing the gun, the pressure acts on the mushroom head of the vent and compresses the pad against the breech screw, causing it to expand. This expansion is radial to the axis and equal in every direction, and is sufficient to prevent the escape of gas. On the pressure being removed elasticity comes into play and the obturator can be withdrawn from the coned seat by a straight pull, which can be given so soon as the screw is unlocked.

Full instructions regarding the fitting, testing, adjusting and treatment of pad obturators are contained in "Regulations for Magazines and Care of War Matériel."

TO DISMANTLE THE BREECH MECHANISM.

Before removing the mechanism, the breech must be opened and the breech mechanism swung in to the loading position.

Vent Axial.

Unscrew the nut of the vent and withdraw the vent with obturating pad and discs from the front end of the breech screw. Withdraw the nut and sleeve from the rear.

Breech Screw, Sliding Block and Bush.

Press in the catch retaining breech screw and turn the latter into the closed position on the carrier. Take out the fixing screw of the "bracket, catch, retaining breech screw" and remove the bracket in a downward direction. Take out the check screw of the link axis pin and remove the axis pin. Turn the breech screw on the carrier so as to clear the interruptions and withdraw it.

Withdraw the sliding block and bush from the carrier.

Lever, Breech Mechanism and Link, Breech Screw.

Remove the keep-pin, nut and disc spring from the breech mechanism lever stud and withdraw the lever and link.

Carrier.

Swing the carrier into the closed position. Remove the keep pin and nut from the hinge bolt and withdraw the hinge bolt with bronze bush from the hinge joint. Remove the carrier.

Shot Guide.

Take out the hinge screw and withdraw the guide block. Take out locking plate and fixing screws of the bracket supporting actuating lever and withdraw the bracket and lever.

TO ASSEMBLE BREECH MECHANISM.

The breech mechanism is assembled in the reverse order.

To dismantle the "P.H." lock and "V" slide box.

To remove the lock and slide box.—Open the lock. Remove the slide box securing screw. Unscrew the lock and slide box from the stem of the axial vent or outer end of vent bush spindle.

To remove the lock from the slide box.—Remove the axis screw of the extractor. Press down the knob of the retaining catch plunger, then turn the actuating lever to the open position and remove the lock and extractor from the slide box.

To dismantle or change the striker.—Remove the lock from the slide box. Unscrew the actuating lever (left-handed thread). Remove the keep pin of the striker cap and withdraw the cap. Withdraw the striker from the actuating lever. Unscrew the striker nut. Withdraw the rebound collar, mainspring and mainspring collar from the striker spindle.

To dismantle the actuating lever.—Remove the keep pin. Remove the retaining catch guide pin. Withdraw the plunger and spring.

To assemble the "P.H." lock and "V" slide box.

The lock and slide box are assembled in the reverse order.

CARE AND PRESERVATION OF GUN AND FITTINGS.

(See also "Regulations for Magazines and Care of War Matériel.")

The breech fittings should work easily and be free from cracks and burrs. Should the screw not work easily, the defect may often be remedied by careful filing, but no portion of the thread should be cut to remove a crack.

The breech should be kept covered by the canvas cover, when possible, to prevent dust and grit getting into the interstices of the breech fittings.

The oil holes in the breech fittings require to have the screws occasionally removed and oil poured into the channels so as to lubricate the parts without removal of the fittings. Care must be taken to replace the screws immediately after oiling.

Should the nut of the vent bush spindle work loose, the lock should be held in a vertical position, using No. 199 B.M. wrench, and the nut tightened up with No. 173 B.M. wrench.

LIST OF LUBRICATING HOLES.

Fittings to be lubricated.	Number of Holes.	Position of Holes.
GUN.		
Block, sliding, and bush	1	In carrier on left side
Carrier, hinge bolt and bush	1	Top of hinge bolt nut
Link, actuating, breech screw	1	Upper side of link
Pin, axis, link, actuating, breech screw	1	Upper end of axis pin
Screw, breech	1	In plain portion of screw
Shot guide	1	In boss of guide block
Stud, breech mechanism lever	1	In carrier on right side

CARRIAGE, FIELD, B.L., 60-PR., MARK I.

(Plate VI.)

The carriage, which is on the "long recoil" principle, is constructed to allow 21-degrees 30-minutes elevation and 5-degrees depression being given to the gun.

The gun fits into a cradle in which it is free to recoil under the control of an hydraulic buffer, and is returned back to the firing position after recoil by spring presses.

The cradle is pivoted by trunnions to a carriage body, and between these two fittings is interposed the elevating gear.

The carriage body is pivoted at its centre in front to a saddle in such a manner that its rear end can be moved laterally across the saddle through an angle of 4°R. and 4°L., the movement being controlled by the traversing gear, so that small changes in direction can be given without disturbing the spade.

The saddle is clipped to the trail flanges in such a manner as to allow the whole of the parts above the latter being run back to the travelling position when required in order to distribute the load over the limber and carriage wheels.

The trail is mounted upon a first class "B" pattern axletree and wheels, and is provided with screw brakes which are for use when firing and travelling. It is fitted with a spade on its rear underside to anchor the carriage and so provide a fixed platform when in action.

The carriages are fitted with the No. 6 carrier and No. 7 dial sight on the left side, and a tangent sight and fore sight and No. 1 dial sight on the right.

The parts of the carriage are :—

Trail
Axletree and wheels
Brake gear
Saddle
Carriage body
Traversing gear
Cradle
Hydraulic buffer
Running-out presses
Elevating gear
Sighting gear

TRAIL.

The trail consists of two parallel side pieces connected by transoms and a top and bottom plate. Angle steel strengthening stays are riveted to the outside of each side piece. A M.B. bracket is riveted to each side piece in which are formed the bearings for the axletree. The front top sides of the trail are prepared to receive locking bolts which secure the saddle in the firing position. About the centre of each side is fitted a housing stop, which fits in front of and retains the saddle in the travelling position. The top of the trail is flanged for the reception of the saddle. The rear end is fitted with locking plates, lifting handles, sole plate, trail eye and a fixed spade. The trail eye

is fitted with a stop to prevent it over-riding the pin-hole in the coupling block when limbering up. Sockets for handspikes are provided for lifting the trail and a clamping arrangement with a removable gun rest to clamp the gun to the trail when travelling, in order to prevent any undue strains coming on the elevating and traversing gears. The gun rest must be removed when in action. Brackets are fitted to the trail under the axletree to take the head of the No. 2 lifting jack.

A chequered footboard, with battens fixed across it on which the loading numbers stand, is fitted to the bottom plate inside the trail brackets.

Steps are fitted to each side of the trail in front and to the left side about the centre.

AXLETREE AND WHEELS.

Axletree.—The axletree, which is first class "B" pattern No. 3, is a tubular steel forging. It passes through the bearings in the trail and is held in position by screwed collars which screw on to the axletree and bear up against the inside and outside of each bearing, and by set screws, the points of which pass through the top of the bearing and enter recesses in the axletree to prevent the latter turning. Each shoulder is fitted with a dust excluder, consisting of a carrier in which is placed an L-shaped leather ring, held in position by a plate secured to the carrier by screws. The leather envelops the inner end of the pipe-box and thus prevents the ingress of grit or dirt.

The outer end of each arm is fitted for a linch pin and an adjusting collar, which has a number of recesses (through which the linch pin passes) cut in one face; the recesses are of varying depth, so that any reduction, due to wear, in the length of the pipe-box can be taken up.

A draught link is fitted to the centre of the axletree and is braced by a stay at the breast of the trail. The front end of the link is forked and fitted with a pin for coupling up another limber when travelling in series.

Wheels.—The wheels are first class "B" pattern No. 12, 5-feet in diameter, with 14 spokes of oak, 7 felloes of ash, and a 6-inch \times $\frac{3}{4}$ -inch steel ring tyre with rounded edges.

The nave consists of a M.B. pipe-box, which is in one piece with the back flange. The inner end of the pipe-box is shaped to fit the dust excluder, while its outer end is screwed to receive a bearing for the drag-washer and a dust cap. The front flange fits over the outer end of the pipe-box, and is connected to the back flange by 14 nave bolts, which pass in between the feet of the spokes and are nutted up back and front alternately. The drag washer is free to revolve around a bearing which screws on to the outer end of the pipe-box against a shoulder; the bearing also forms a stop for a dust cap which screws on to the pipe-box and is secured to the bearing by two pins.

The feet of the spokes fit in between the flanges, while their upper ends fit into spoke shoes which are riveted to the felloes. The tongue of every alternate spoke fits in a recess at the joint of the felloes and so

form dowels to keep the latter in place. The tyre is secured to the felloes by 14 tyre bolts, two to each felloe. They are countersunk on the outside and nutted up on the bosom of the felloe.

BRAKE GEAR.

(Plate VII.)

The brake gear is of the swinging arm type, each side acting independently.

The gear on either side consists of a channel steel brake arm pivoted at its inner end to a bracket on the trail and strengthened by a round supporting stay. The outer end has a shoe in which is dovetailed a cast-iron brake block to bear against the tyre of the wheel. Near its outer end the brake arm has bolted to it a M.B. cylinder, which is screwed internally to form a nut. The cylinder is square in section where it passes through the arm, to prevent it turning, and is fitted with disc springs to give resilience in the gear to prevent the wheel becoming dead locked. Working in the nut is the rear screw-threaded end of an actuating rod, which is supported in bearings in the axletree bracket and prevented from end movement by a shoulder in front and a collar in rear of the bearing. The rod is turned by means of a hand-wheel, the rim of which is covered with leather, nutted to its front end.

SADDLE.

The saddle forms an intermediary between the trail and carriage body, and allows the latter to be run back along the trail for travelling, as well as allowing top traverse.

It consists of a front and rear slide connected by two M.B. or steel side bars bolted on, a brass dust excluder is attached to each of the bars by means of three distance collars and rivets for the purpose of keeping the wearing surfaces free from grit. A steel plate, fixed across the front slide is pierced to the left of the centre to receive the pivot pin of the carriage body. The slides are clipped to the top flanges of the trail by under clips and in addition they are engaged by clips on the carriage body.

The front slide is prepared on either side to take a tapered steel locking bolt for securing the saddle to the trail in the firing position, while the rear slide has prepared surfaces on which the rear of the carriage body rests and traverses; a socket is formed at its left rear for the swivel bearing of the traversing gear.

CARRIAGE BODY.

The carriage body consists of two forged steel side pieces joined by transoms and also by a plate at the front, in which is an opening through which the pin pivoting the body to the saddle passes. Bearings are formed on the top of each side piece to receive the cradle trunnions, which are held by sliding capsquares, secured by keys. Clips are bolted to the side pieces to engage with the saddle. The rear ends of the side pieces are prepared to traverse on the rear slides of the saddle. The left side piece carries the bracket for the elevating gear while the left rear holding-down clip is prepared for the attachment of

the screw of the traversing gear. A bollard is fitted to the outside of each side piece, over which the running end of the rope is passed when shifting from firing to travelling position, and *vice versa*.

The carriage body is pivoted to the left of the centre of the trail in order to give clearance on recoil to the lug of the breech mechanism hinge bolt, which projects from the line of the gun on the right.

TRAVERSING GEAR.

The traversing gear consists of a handwheel fixed to the outer end of a tubular nut, which works in a swivel bearing, pivoted to the left rear of the saddle. Working in the nut is a steel screw connected to the left rear holding-down clip of the carriage body. By working the gear, the rear end of the carriage body can be moved through an angle of 4° R. and 4° L., except that when the elevation exceeds $16\frac{1}{2}^{\circ}$, stops, on the elevating arc and saddle, limit the angle to 3° either way. The stops are necessary in order to prevent the gun fouling the inside of the trail brackets on recoil.

The amount of traverse is indicated by a pointer fixed to the saddle, which reads to a graduated scale on the rear transom of the carriage body.

CRADLE.

The cradle is a M.B. casting, consisting of front and rear collars, joined by side pieces. Each collar has four openings, the largest below to take the gun, the small centre one above to take the hydraulic buffer and two side openings for the spring presses. The gun opening has a guideway on either side to take the guides on the gun.

The front collar has trunnions cast on it to fit into the trunnion bearings of the carriage body. A semi-circular brass sheet cover fits over the gun in between the collars and is bolted to the side pieces of the cradle.

Carriages will, in future, be provided on each side of the cradle, with three eyes for lashing the "Mat, protecting running out presses," in lieu of three of the screws securing cradle cover.

The eyes are so arranged as to assist also in securing the cradle cover.

Fittings for sights are provided on either side of the cradle, and consist principally on the left side of two adjusting studs (one eccentric and one plain) with set screws, and a steadying stud for the attachment of the oscillating sight,† whilst the right side has brackets for carrying a fore and tangent sight.

Later carriages are not fitted with the brackets on the right, but have machined faces to which the brackets can be attached if required.

Later pattern cradles differ from the original pattern in being of strengthened design outside the keyways and having a removable liner fitted to the keyways. The liner is made in three portions, the two shorter portions at front and rear being arranged for replacement purposes due to wear; these short portions are identical as regards dimensions and method of fixing with those used to repair the existing cradles, so that the removable liners will be interchangeable between new and existing cradles.

A clinometer plane is provided on its top rear surface.

† NOTE.—The oscillating sight is now obsolete.

HYDRAULIC BUFFER AND RUNNING-OUT PRESSES.

(Plates VIII and IX.)

Hydraulic buffer.—The Mark I hydraulic buffer consists of a steel cylinder which is secured in the cradle collars by a feather and feather way, and by screw collars retained by set screws. A M.B. valve key, shaped to graduate the pressure throughout recoil, is dovetailed into the bottom of the buffer inside and is further secured, near the rear end, by a bolt and locking band. Working inside the cylinder is a piston which is of steel in one forging with the rod and control plunger. The piston has a port cut in it shaped to work over the valve key and a M.B. ring is let into it to prevent scoring of the cylinder. The piston rod passes out through the rear end of the cylinder and is nutted up to a lug on top of the gun. The rear end of the buffer cylinder is closed by a stuffing box with leather washer; the stuffing box contains an L-shaped leather held in by a screwed securing ring in its inner face and coils of greased packing held by a gland in its outer face. The front end of the buffer is closed by a M.B. cylinder in which is bored two openings; the top one forms a tank to contain liquid in order to keep the buffer full in case of leakage, two diagonal passages connecting the tank permanently to the buffer, while the lower one, which is co-axial with the buffer, forms a chamber for the control plunger to work in. The latter is formed on the front of the piston; it tapers towards its front end and has a tapering flat filed on it in the direction of its length. The flat narrows off towards the rear end, at which point a recess is cut in the plunger, top and bottom, to give a greater clearance for the last movement of running up.

A bye-pass valve will in future be provided between tank and control chamber by means of which the resistance offered to the control plunger in the final stages of run up can be regulated. The arrangement permits of liquid passing from control chamber to tank past a screw valve manipulated by links from the breech end of the gun. It is primarily intended for use at extreme angles of elevation. Facilities are provided to retain the valve at any given setting. Care must be taken to close the valve if a change of target involving a change in elevation from a high to a low angle is ordered, otherwise violent run up may be experienced. Generally speaking the valve should be closed at angles of 12° and below.

A filling hole is provided at the front end of the tank. In addition there is an air-hole on top of the tank in rear which communicates with the buffer, an air-hole on the top front end of the buffer, and another air-hole at the front end of the control chamber. These holes are closed by screwed plugs which are marked "A," "B," "C" and "D" respectively. The buffer is filled with mineral oil. Quantity required, about 5-quarts. For filling and care and preservation, see page 19.

The *Mark II* hydraulic buffer differs from the *Mark I* principally in being fitted with two valve keys dovetailed into the top and bottom of the buffer, respectively, and in the valve key bolt locking band being formed for the reception of two bolts instead of one as hitherto. The piston for the *Mark II* buffer is cut with two ports to suit the two valve keys, the piston ring being in two segments, one on each side of the ports, each segment being secured in position by two rivets. When

carriages are provided with this mark of buffer, a plate stamped—"Buffer, Mark II, with two valve keys" will be attached to the buffer.

Running-out presses, Mark I.—The running-out presses are contained in steel cases, secured to the cradle above the gun, one on each side of the hydraulic buffer. Each press consists of two banks of springs, outer and inner. There are four spiral springs in each bank, two of which are wound right hand and two left. The rear end of the outer bank takes a bearing against a M.B. centring ring, which, in turn, bears against a flange on the rear collar of the cradle, while its front end bears against a flange on the front end of the inner spring case, which fits inside the outer bank of springs. The inner bank fits inside the inner spring case, the rear spring bears against a flange at the rear end of the inner spring case and the front one against a bearing plate, which, in turn, bears against a shoulder formed on a steel "screw, compressing springs." The inner springs are also divided by bearings. To obviate the possibility of the spring presses being forced forward out of the spring cases, running-out presses are provided with stops. The running-out press stop is of steel and consists of a bracket, clip and hinge pin and keep pin. The bracket which is prepared for the reception of the clip, is fixed to the front of the spring case. The clip is secured in position on the bracket by means of a hinge pin with keep pin.

The screw, compressing springs, is screwed into the front end of a tubular running-out rod or cylinder which extends the whole length of the springs, the screw, rod and bearing being pinned together when the former has been screwed home. For future manufacture this pin is omitted. Against the rear end of the rod is placed a retaining plate which holds the centring ring in position while the springs are being assembled, held in position by a lug, which screws into the rear end of the rod. To the lug is pinned a link and coupling through which the springs are connected to the gun lug. The front end of the outer spring cases are closed by caps pinned to them. Bullet-proof shields in two parts are fitted over the exposed portions of the outer spring cases.

Running-out presses, Marks II and I.*—The *Mark II* running-out press differs from the above in having the inner spring case reinforced as shown on Plate IX.

The reinforcing arrangement consists of four tension bolts passed through holes in the retaining plate, rear and front bearings of the inner spring case, and a cap which fits over the rods at their front ends, the cap being secured on the rods by nuts and pins. The head of each bolt is slotted to receive a stud which is fitted to the retaining plate at the rear. The cap is shaped to take a bearing against the ring bearing of the inner spring case and it also serves to prevent the ingress of dirt and dust, the original pinned-on cap being removed from the outer spring case.

In addition, the central hole in the retaining plate is larger to allow the connecting lug and running-out rods to pass easily through. The plate, after the reinforcing gear has been assembled, becomes an integral part of the inner spring case.

The dividing bearings are of steel instead of M.B.

Existing *Mark I* presses when fitted with the reinforcing arrangement are designated *Mark I**.

Action.—On firing, the gun recoils and draws the piston rod and running out rods with it to the rear; the liquid in the cylinder passes from one side of the piston to the other through the port and over the valve key. In doing so an hydraulic resistance is set up, which absorbs the energy of recoil, while the shape of the valve key is such as to graduate the pressure in the buffer throughout recoil. As the running-out rods are drawn back, the springs are further compressed, and after recoil has ceased, they expand and return the gun to the firing position. During this movement, the control plunger re-enters its chamber and displaces the liquid over the tapering flat, which results in the gun being brought to rest in the firing position without violence.

The amount of recoil is indicated by a scale of inches marked on the left guide rib of the gun. The average working recoil is 55-inches and metal to metal 60.775-inches, the safe limit of recoil being 57-inches, and should this limit be exceeded the buffer must be attended to.

ELEVATING GEAR.

The elevating gear is carried on a bracket which is bolted to the rear end of the left side piece of the carriage body.

It consists of a handwheel on the rear end of a short longitudinal spindle, which carries on its front end a worm. The worm gears into a worm-wheel on the outer end of a short cross spindle on the inner end of which is a spur pinion, which gears into an elevating arc, bolted to the left side of the cradle. The worm and worm-wheel are closed in by a bronze cover.

A locking device is fitted inside the worm to prevent the gear running down as the gun is recoiling. This device is so arranged as to permit of the worm being actuated by the spindle, but instantly checks any motion from the worm-wheel, by the worm becoming locked by rollers which are jammed between a path on the worm and another on a bearing fixed to the elevating bracket.

When the handwheel is revolved, the motion of the spindle first releases the rollers and then drives the worm. On releasing the handwheel, the rollers are again jammed by springs fitted between them between the two paths, and the worm is thus locked to the fixed bracket. The elevation is limited by the cradle coming against the transom of the carriage body, except that when more than 3° top traverse R. or L. has been given to the latter, a stop on the elevating arc fouls stops on the saddle and limits the elevation to 16½-degrees.

NOTE.—The *Mark II* carriage is obsolete.

CARRIAGE, FIELD, B.L., 60-PR., MARK III.

(Plates X and XI.)

The *Mark III* carriage differs principally from the *Mark I* in that the saddle is dispensed with, consequently the flange on the top of each trail bracket is omitted. The carriage is pivoted direct to the

trail, the gun only being pulled back when shifting to the travelling position.

The chief differences are :—

Trail.—The construction of the trail is generally similar to that for the *Mark I* except that it is not fitted with locking bolts, housing stops or removable gun rest.

It consists of two side brackets connected by front, rear and intermediate transoms, bottom plate, and at the lower end by a wrapping plate. The side brackets are parallel for a distance of nearly 4-feet at their front ends, opening out from this point to near their lower ends, where they are again parallel. This is done to give clearance to the gun when recoiling at large angles of elevation.

The front transom is pierced vertically through its centre to receive the pivot pin of the carriage body, which also passes through a bearing plate riveted to the top of the transom.

The intermediate transom has a prepared surface on either side on which the rear end of the carriage body rests and traverses. Holding-down clips, bolted to the front transom, engage brackets on the carriage body and so prevent the latter lifting on firing.

The rear end of the trail is fitted with a bracket, to which is pivoted a connector for limbering up. The bracket is so arranged that the connector can be pinned clear of the ground when unlimbered and the spade buried.

Two brackets are also provided near the rear end of the trail, one on each side, to take a removable gun rest by means of which the breech end of the gun is supported when in the travelling position.

The remainder of the fittings are similar to those for the *Mark I* carriages.

Axletree.—This is 1st Class “B” pattern No. 13, it is generally similar to the No. 3 used with the *Mark I* carriage, and is secured in a similar manner.

Carriage body.—Similar to the *Mark I* except that the body is pivoted centrally and the bollards fitted to the *Mark I* carriage are not required.

Traversing gear.—This is interposed between the trail and carriage body but is otherwise similar to the *Mark I*. The maximum traverse is 4° R and L for all angles up to $16^{\circ} 30'$ elevation, between $16^{\circ} 30'$ and $21^{\circ} 30'$ the limit of traverse is 4° L and 3° R. The traversing stops and pointer are fixed to the trail.

Hydraulic buffer.—The *Mark I* buffer is generally similar to the *Mark I* buffer of the *Mark I* carriage, except that instead of being fitted with a valve key in cylinder and port in piston, the cylinder has tapered grooves cut in it, the piston being plain; so that on recoil the oil passes from one side of the piston to the other through the grooves, which regulates the pressure and absorbs the energy of recoil. The *Mark II* buffer is the same as the *Mark II* buffer for the *Mark I* carriage. See page 15.

Gun hauling gear.—The hauling gear which is used for shifting the gun to the travelling or firing position consists of a crosshead and two

heavy drag-ropes. The crosshead is of hollow steel packed with wood and provided at each end with a G.M. sheave. At the centre of the crosshead a steel muzzle ring is bolted. Four brass segments, the diameter of which is 5-inches to suit the bore of the gun, are riveted to the outer circumference of the ring. At the ends and on the reverse side of the crosshead, two steel brackets are riveted. These brackets are shaped to suit the contour of the gun at the breech above the breech opening.

The breech end of the gun is supported when in the travelling position by means of a removable steel gun rest which is keyed to brackets on the trail. The upper surface of the gun rest is fitted with a leather strip and a stop, the latter limits the movement of the gun when shifting to the travelling position.

The gun is secured in the travelling position by means of a wire rope with adjustable shackle. A complete turn of the rope is taken around the gun near the breech and the ends secured to eyebolts on the trail brackets, any slack being taken up by the adjustable shackle.

The remaining parts of the carriage are the same as the *Mark I*.

CARE AND PRESERVATION OF CARRIAGE, &c.

MARK I CARRIAGE.

Before running the gun up to the firing position, the handspikes and rammer, which are carried in the trail, must be removed.

When it is required to move the gun to the travelling position, the bolts C (Plate VI) for locking the saddle to the trail must *not* be removed until the carriage is limbered up, and the carriage must *not* be unlimbered, with the gun in the firing position, unless the saddle is secured to the trail by the locking bolts "C." When moving with the gun in the travelling position, the saddle must be secured to the trail by the housing stop "B" and the gun by the clamp "A."

The gun rest "D" must be removed from the trail when the gun is in the firing position.

MARKS I AND III CARRIAGES.

Precautions before firing.—Before firing, care must be taken to see that the buffer has been correctly filled, the piston rod and running-out rods properly nutted up to the lug of the gun, and that there is no leakage at the stuffing-box gland, joint of tank, or at the filling and air plugs.

The adjustment of the sights should be verified and all gears should be oiled and in good working order.

To fill the buffer.—Elevate the gun to not less than 10-degrees of elevation. Disconnect one running-out press. Remove plug "A" at filling hole in front of tank, air screws "B" and "C" on top of tank and buffer and air screw "D" from front of control chamber.

Pour in liquid at "A" until pure liquid flows out at "C," close "C." Attach a tackle to the gun and pull it back in the cradle until the controlling plunger is clear of the control chamber, *i.e.*, about 2-feet 6-inches, and continue pouring in liquid until pure liquid flows from "B" and "D." Close "B" and "D," and complete filling of tank. Allow the gun to run up *slowly* and catch the overflow of oil from the filling hole "A." When the gun is completely home in the cradle, draw off a quarter of a pint of liquid from "A." The "A" plug should then be replaced and the running-out press connected up. The amount of liquid required is about 10-pints.

To tighten or repack the gland.—If any leakage takes place at the gland it should be tightened; if this does not stop the leak the packing must be removed and renewed.

To renew the greased packing.—Pull the gun back in its cradle a convenient distance to the rear by means of a tackle; unscrew the gland, extract the defective packing, and insert new (about 16-inches of $\frac{3}{4}$ -inch greased packing cut to suitable lengths to fit round the piston rod is required), each coil breaking joint. Screw the gland home and allow the gun to run up into firing position.

To renew the L-leather ring in the stuffing box.—Lay the gun horizontal. Disconnect the piston rod and the running-out rods from the lug on the gun. Pull the latter back in its cradle till its lug is well clear of the piston rod and lash it securely to the cradle. Remove the front nut of the piston rod. Unscrew and remove the gland and the greased packing. Slightly elevate the gun and unscrew the stuffing-box, receiving the oil in suitable vessels. Unscrew the securing ring from the stuffing box and remove the latter, L-leather and securing ring from the piston rod. Thoroughly clean and lubricate the threads of the buffer, stuffing box and glands. Place the securing ring on the piston rod, follow this up with a new L-leather which has been well dubbed, being careful to see that the edge of the leather is not damaged in passing it over the threads on the rod; pass on the stuffing box with leather washer in position. Push the L-leather into its recess in the stuffing box and screw in its securing ring. Screw the box home into the buffer against its leather washer. Replace the greased packing, each coil breaking joint, and screw in the gland. Replace the front nut on the piston rod, run the gun into the firing position, connect up piston rod and running-out rods and refill the buffer. Before carrying out the latter operation, however, the leather washers of the filling and airplugs, also the tin washer at the tank joint, should be examined and replaced if necessary.

Replacement limits of running-out springs.—The normal length of each running-out spring is as follows:—

							Inches.
Inner	..	..	..	..	..	..	28.9
Outer	..	..	..	..	..	..	30.5

Any one spring, inner or outer, found with a permanent set of 2.9-inches and 3-inches respectively (or more) below the normal free length of the spring, will be replaced.

The undermentioned tools are used in assembling and dis-assembling the springs :—

Tools, assembling springs, B.L. 60-pr. Marks I and III carriages :—
 Blocks, wood, V.
 Stave, 8-feet by 1½-inch
 Wrench
 Tommy, No. 12.

MARK I RUNNING-OUT PRESS.

To remove a running-out press.—Detach the cap from the front end of the outer spring case, slacken the nut on the coupling at the rear end sufficient to release the tension and remove the pin from the connecting lug (O) (Plate VIII). The press may then be withdrawn from the case. To replace a spring press, the order of the above operations is reversed.

To remove a spring.—Place the press on the wood blocks. Remove the split pin (V) from the front end by compressing the springs to bring the pin clear of the end plate. This can be done by making a drag rope (double) fast to the shackle end, and at the other end of the springs making a Spanish windlass with a hammer shaft. Unwind the screw (C) with No. 264 spanner, and prevent the rod (P) from turning by means of a tommy passed through the lug (O) as a stop. When the screw is detached from the rod, remove the damaged spring.

To assemble the press.—Place the outer springs (A), alternately right and left wound, on the inner spring case (E). Pass the rod (P) with the retaining plate (M) and centring ring in position into the inner spring case through the bearing (F). Place an inner spring (B), and a dividing bearing (S) within the inner case and over the rod. Repeat this operation until the inner case is full, using the ash stave to centre the dividing bearings and inserting the springs alternately right and left wound. When the spring case is full, place the remaining components on the screw (C) in the following order :—Bearing ring (G), inner spring (B), dividing bearing (S), and so on till all the parts are assembled. Engage the screw (C) with the rod (P), and, with the No. 264 spanner, turn the screw into the rod until the front end of the rod engages with the shoulder on the front end of the screw, using a tommy in the lug (O) to prevent the rod from turning. With the horseshoe wrench and a tommy turn the bearing (G) by engaging the open ends of the wrench with the ribs of the bearing until the holes through the screw, rod and bearing for the split pin are in the same straight line. Replace the split pin.

MARKS I* AND II RUNNING-OUT PRESSES.

To remove a running-out press.—Remove the stop from the front end of the outer spring case and the pin from the connecting lug (O) (Plate IX). The press may then be withdrawn from the case.

To remove a spring.—Remove the press complete. Remove the pins and nuts of the tension bolts (Plate IX) and take off the cap. The tension bolts can then be removed from the rear. Unwind the

screw (C) (Plate IX) with No. 264 spanner and prevent the rod (P) from turning by means of a tommy passed through the lug (O) as a stop. The front end of the screw (C) should be supported as it is withdrawn to prevent distortion of the rod. When the screw is detached from the rod remove the damaged spring.

To assemble the press.—Place the outer springs (A) alternately right and left wound on the inner spring case (E). Insert the rod with bearing (F) from the rear and place an inner spring with a dividing bearing from the front within the inner spring case and over the rod. Repeat this operation until all springs are assembled, inserting the springs alternately right and left wound. Insert the screw with bearing (G) from the front, engage it with the rod and screw up with No. 264 spanner, preventing the rod from turning by means of a tommy as above. Care should be taken that the screw is kept central, otherwise difficulty will be experienced in screwing it right home. Insert the tension bolts from the rear, taking care that they are not crossed within the inner spring case. Replace the cap and the nuts and pins of the tension bolts.

During severe weather, buffers and recuperators will be protected as much as possible from the cold by covering them with sandbags, sacking or straw, &c., and, when possible, by keeping the gun pits warm by means of braziers or stoves.

Buffer oil should be efficient at temperatures down to 0° Fahr.

LIST OF LUBRICATING HOLES.

Fittings to be lubricated.	Number of Holes.	Position of Holes.
CARRIAGE.		
Carriage body	2	1 on each side where the carriage is clipped to the traversing surfaces
Bracket, elevating gear ...	3	1 for lubricating the arc pinion and two for worm spindle
Pin, joint, traversing screw	1	In head of pin
Pivot, traversing	1	On top for lubricating nut and screw
Cradle body	7	4 on right side and 3 on left, for lubricating gun slides
Capsquares (2) each	1	On top, for lubricating trunnions
Saddle	7	4 on right side and 3 on left under covers, for lubricating the sliding surfaces
Nuts, actuating rod, brake gear (2) each	1	On left and right side

LIMBER, B.L. 60-PR. CARRIAGE, MARK I.

(Plate XII.)

The limber consists of a steel frame, coupling arrangements, two steel boxes, a 1st class axletree, draught fittings, and two wheels.

The frame consists principally of four futchels (two inner and two outer) connected at the rear to the axletree by flanges, at the front by connecting plates and strengthened by diagonal stays. A pintle with pin is fitted to the centre futchels above the axletree. The arrangement for coupling the carriage to the limber consists of a coupling block and a draught bar. The front end of the coupling block is supported by the body of the pintle, the stem passing through a link formed at its front end; the rear end is box shaped to receive the trail eye of the carriage. The block is coupled to the axletree by a radial draught bar, which is pivoted at the front end to a steel strap placed about the centre of the axletree and is connected at the rear end to the block by a bolt. The trail eye of the carriage is secured to the block by a loop-headed connecting pin attached to a fixed key by a chain. To lock the pin, an opening in the head must be placed over the key and the pin rotated. Two rope handles are attached to the coupling block to facilitate the lowering of the block when the gun is unlimbered. The plates which connect the futchels at the front, and serve the purpose of a splinter bar, are fitted with a pole socket, draught hooks and outriggers with stays and hooks for four-horse draught. Draught joints with coupling pins are also fitted for the attachment of an engine draught connector. To the rear of the pole socket two plates are fixed above and below the inner futchels to support a No. 17 Mark III draught pole, which may be used (instead of No. 19) on an emergency and which should be further supported by suitable packing placed around the pole socket. Brackets are fitted to the outer futchels to facilitate the raising of the limber by a lifting jack.

Two steel boxes for carrying sights, telescope, spare parts and small stores are fitted, one on each side; the lids open at the top and are fastened at the rear by hasps and turnbuckles and provided with padlocks. A steel tray and bronze bracket are fitted to the rear of each box to support a projectile when the carriage is limbered up and the gun is in the firing position. The projectile is secured by a strap.

A wire net receptacle is fixed below the boxes for carrying the drag ropes and lashings.

A board with clips for carrying two rifles in covers is attached to the frame in front of the boxes.

The boxes are fitted to carry the various stores shown on diagram "B," page 52, and diagram "C," page 53.

The fittings for draught consist of a No. 19 draught pole, with four No. 12 swingletrees and a No. 4 pole bar for horse draught; a connector, No. 3, is provided for engine draught. The pole and bar are for use with the G.S. pole draught harness. The pole is 12-feet 2·8-inches long (over all); the front end is protected by steel

wrapping plates; a U-shaped tug is passed through the pole from the under side and secured by a nut on the top. The tug forms a stop for the pole bar and its position from the point of the pole may be varied from 26½-inches to 14½-inches, in distances of 3-inches, according to requirements. The front end of the pole is prepared for two stop bolts, which are only required when bullock draught is used. The No. 4 pole bar is 4-feet 3½-inches in length and is fitted at the centre with a circular loop, which is formed to pass over the front end of the pole and butt against the tug. Two links are fitted on each side of the loop, by means of which the bar is attached to the neck piece of the harness. The swingletrees are 2-feet 5·8-inches long. The engine draught connector is V-shaped; a coupling bolt (with a volute spring) passes through an opening in the apex and the forked ends are formed with lugs for attachment to the draught joints on the limber.

A yoke and chains for bullock draught can be used with the limber as required. The chains will be attached to the draught joints of the splinter bar by the hooks or first link, as may be found most convenient.

The axletree, which is 1st Class "B" No. 4, is of tubular steel, and is fixed by flanges to the futchels. The linch pin and adjusting collar are the same as for the carriage, and the outer flanges are provided with dust excluders, which are similar to those on the carriage.

The wheels are 1st class "B" pattern No. 10. They are 5-feet in diameter, having 14 spokes, 7 felloes, 2 M.B. flanges, a removable P.B. pipe-box and a 6-inch steel ring tyre with rounded edges. The pipe-box passes through the flanges and is connected to the inner one by a bolt. Its inner end is shaped to fit into the dust excluder and its outer end is screwed to receive a bearing for the drag-washer and a dust cap, the latter being secured to the bearing by two pins. The flanges are bolted together by 14 nave bolts, which pass through the feet of the spokes and are nutted up back and front alternately.

The tyre is secured to the felloes by 14 tire bolts, 2 to each felloe, which fit into countersunk holes on the outside and are nutted up on the bosom of the felloe.

The limber is fitted to carry various stores as shown at page 47, also on Packing Diagram "A," page 52.

Note.—These limbers are suitable only for the *Mark I* carriages.

LIMBER, B.L. 60-PR., CARRIAGE, MARK II*. (Plate XIII.)

The *Mark II** limber is generally similar to the *Mark I*, from which it differs only in the limbering up arrangements. The pintle, coupling block and draught bar are omitted, and a spring limber hook to receive the "connector, limber" is riveted to the back of the centre futchels just in rear of the axletree.

The axletree is 1st Class "B" pattern, No. 308. The wheels are No. 10.

In order to adjust the weight on the draught pole two shell carriers are fitted across the futchels of the limber, one on the upper side

and one on the under side immediately behind the draught pole socket; they extend the full width of the limber framing and each contain two shrapnel shell.

LIMBER, B.L. 60-PR., WAGON, MARK II.

(Plates XIV and XV.)

The limber consists of a steel frame with limber hook, ammunition box, draught fittings, a 2nd class axletree and two field wheels.

FRAME AND LIMBER HOOK.

The frame consists of four futchels connected by stays and provided with flanges by which the axletree is secured. The outer flanges are fitted with dust excluders. A draught hook is fitted to the front end of each outer futchel to take the swingletrees, and between the two centre futchels the pole staple and shoe for nib iron are arranged. To the front end of the futchels foot and platform boards are fixed. The limber hook (No. 31A) is attached to the rear end of the centre futchels and is of the keyless type, the catch of which is mounted on a spindle having a thumb press on its right end for unlimbering purposes.

Action of limber hook.—In limbering up, the catch is depressed by the pressure of the perch eye; when the eye has passed below the catch, the latter is automatically returned to the normal or locked position by the action of two spiral springs. To unlimber, the thumb press of the catch is depressed by hand until the perch eye can be disengaged from the hook.

AMMUNITION BOX.

The ammunition box is fixed to the futchels and secured at the ends by vertical flanged plates.

It is provided with detachable guard irons, 3 pairs of rifle clips, 3 hand straps, and a "turnscrew shell plug" for fuze hole plug, in rear on the off side.

The box is closed in rear by 3 lids, the centre lid is hinged at the top and opens upward, the two outer lids are hinged at the bottom and open downwards. Each lid is flanged on the inside to fit a felt-lined groove in the box. The outer lids have hinged shield-plates for the protection of the ammunition numbers. When closing, the outer lids should be closed first and the centre lid last, and when closed they are secured by spring latches and limber locks.

The ammunition box is arranged internally, as shown in Plate XV, to take 8 high explosive and 8 shrapnel shell, 16 cartridges in cylinders, all secured by quick release straps; also 2 fuze boxes and 1 tray small stores. Each shell compartment is provided with a withdrawing strap and packing block for withdrawing the shell. H.E. compartments are painted yellow. The packing diagram, "E," page 53, shows the packing of the various details of spares and equipment, &c.

A wooden fuze locker is fitted on top of the ammunition box, on near side, rear, secured by a steel band, to contain 15 fuzes of the No. 100 type.

DRAUGHT FITTINGS.

The fittings for draught in use are the same as with Mark I Wagon Limber except the swingletrees which are No. 12 (or/3).

AXLETREE AND WHEELS.

Axletree.—The axletree (No. 196) is a tubular steel forging with 2nd class axle arms; it is secured to the frame by the flanges and is prevented from turning by a feather in each outer flange.

Wheels.—The wheels are 2nd class "C" No. 45. They are of double spoke construction, 4-feet 8-inches diameter, 3-inches width of tyre, and furnished with a dust cap. The nave consists of 2 corrugated steel flanges connected together by nave bolts; the inner flange has a steel strengthening ring and the outer a gunmetal centring boss. The flanges fit on a removable phosphor bronze pipe box and are secured by means of a nut, which is prevented from working loose by means of a flat spring attached to the outer flange.

For future manufacture the spring and ratchet teeth will be replaced by a locking plate, which fits over the octagonal nut and has two arms through which it is bolted to the flange, two of the nave bolts being used for this purpose.

A dust cap prevents ingress of dust and dirt to the outer end of the pipe box. It screws on to the pipe box and is secured to the nut by a keep pin.

A drag washer fits on the pipe box nut, on which it is free to revolve, and is retained in position by the dust cap.

The wheel is retained on the axle arm by means of the "collar, adjusting," and "pin, lynch, 2nd class 'C' capped wheels." The adjusting collar enables wear in the direction of the length of the pipe box to be taken up.

WAGON, AMMUNITION, B.L., 60-PR., MARK II.

(Plates XIV and XVI.)

The wagon consists principally of a steel frame, a hollow steel box perch fitted with a perch eye, steel ammunition box, brake gear, 2nd class axletree and two field wheels.

FRAME.

The frame consists of two flanged sides of steel plate connected by stays to the perch, which occupies the centre and projects to the front and is fitted with a (No. 17A) perch eye. Platform and footboards are fitted to the front ends of the sides and perch; a prop is attached to the rear and also two wire net receptacles and brackets for lifting jacks.

The perch is fitted with locking plates, a prop, and two brackets on the underside for carrying a No. 18 (jointed) draught pole. Both front and rear props, when not in use, are secured by spring clips.

Two wooden fuze lockers are fitted under the footboard, one on each side of the perch, secured by steel bands, to contain 15 fuzes of the No. 100 type.

AMMUNITION BOX.

The ammunition box is divided transversely into two main compartments (front and back), and each is closed with a lid, which is hinged at the bottom and opens downward; the front lid when open is supported by the footboard in a horizontal position; the rear lid has a bullet-proof shield plate hinged to its upper edge and when open the lid hangs vertically. Two removable guard irons and two turn-screw shell plugs are fitted to the ammunition box. The interior is divided into three horizontal rows of compartments; the lower row contains 4 H.E. and 4 Shrapnel shell, the middle row contains 2 H.E. and 2 Shrapnel, 2 cartridge cylinders, 1 fuze box and 1 empty compartment, while the upper row contains 10 cartridge cylinders.

The cartridge cylinders and shell are retained in position by quick-release straps and the shell are withdrawn from their compartments by means of packing blocks and withdrawing straps. H.E. compartments are painted yellow.

BRAKE GEAR.

The tyre brake, which acts upon the front of the wheels, is actuated from the rear of the wagon by a handle, and consists principally of two brake arms, connecting and actuating rods, a screwed rod, two cranked levers and two supporting links. The brake arms are pivoted at their inner ends to the perch and are provided at their outer ends with shoes and blocks; they are supported near the shoes by links which depend from the frame sides. A screwed rod on the left side, and an actuating rod on the right, connect the brake arms with cranked levers at the rear of the frame; the cranked levers are connected by means of a connecting rod with an arrangement of disc springs for resiliency. The left cranked lever has a nut through which the screwed rod passes to the rear, the latter has the actuating handle at its rear end.

The brake must always be put on when the wagon is supported by the props.

AXLETREE AND WHEELS.

The axletree and wheels are the same as those used with the limber.

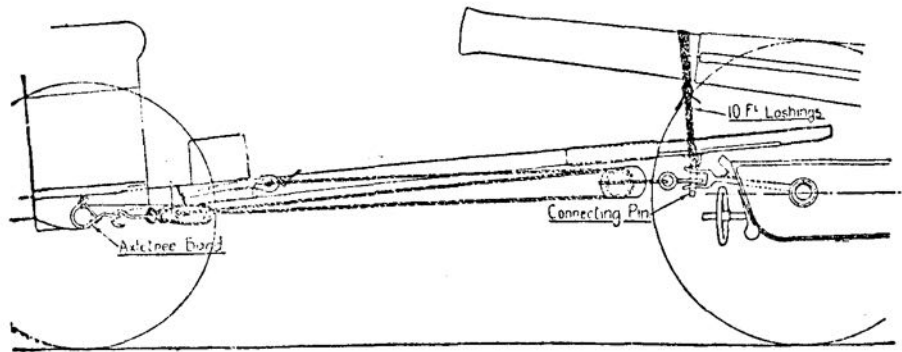
The wagon is fitted to carry the stores, etc., as shown on the packing diagram "E," page 53.

TRAVELLING IN A SERIES.

When it is desired to travel with two or more carriages and carriage limbers in a series, an engine draught connector may be used to couple the splinter bar of the carriage limber to the axletree of the preceding carriage, which is provided with a link and a pin for the purpose.

The wagon limber may be connected to the carriage for engine draught by the attachment of a luff tackle.

The limber will be connected to the carriage as follows (see sketch) :—



Pass the pole tug through the loop of the connecting pin in the carriage and secure the tug to the pole ; lash up the pole to the gun by two 10-ft. lashings, passing the lashing under the pole inside the pole tug, frap the lashing close to the gun and make fast. Hook the single block of the luff tackle to the band on the axletree and the double block to the connecting pin on the carriage. Make fast one end of the luff tackle-fall to one of the draught hooks of the limber, haul on the other end of the fall as tightly as possible and make it fast to the other draught hook of the limber.

This arrangement can only be adopted with the carriage body and gun in the travelling position.

SIGHTING.

The cradle is fitted for a tangent and fore sight and a No. 1 dial sight on the right side and a No. 6 carrier with No. 7 dial sight on the left.

TANGENT SIGHT, MARK I.

The tangent sight consists of a rectangular steel bar surmounted by a crosshead ; a yard scale is engraved on the rear face and a degree scale on the front face of the bar, while on its right side is formed a toothed rack. The yard scale is graduated from 200 to 10,400-yards in multiples of 100, and the degree scale from 0 to 20-degrees in multiples of 10-minutes. The crosshead carries the deflection gear which consists of a traversing screw with milled heads and a nut with leaf in which is cut a V-shaped notch for use in laying. The back of the crosshead is graduated to 2 degrees right and left, sub-divided into intervals of 5-minutes, the graduations being indicated by an arrow scribed on the leaf.

The sight is set and secured at the desired range by an automatic clamp. The clamp consists of a bronze jacket in which is cut a slot for the bar to pass through ; the slot is cut at an angle of $1\frac{1}{2}$ -degrees to

the vertical to compensate for drift. The bracket is recessed at right angles to the slot to receive a spindle, on the inner end of which is formed a worm which gears with the rack on the bar. The worm is kept up to its work by a spiral spring contained in the recess and held in compression by a nut screwed into the bracket. The outer end of the spindle is fitted with a milled head. Turning the milled head raises or lowers the sight slowly. For quick setting, pull the milled head outwards; this disengages the worm from the rack and the sight can then be raised or lowered by hand.

The clamp is held in the bracket on the cradle by a spring catch.

FORE SIGHT, MARK I.

The fore sight consists of a steel pillar with acorn top, screwed into the upper end of a M.B. sleeve in which it is secured by a pin, riveted over. The sleeve has a feather in its lower end, by means of which it is secured in its supporting bracket over the right trunnion of the cradle. Surrounding the pillar is a M.B. jacket which has a feather to fit featherways in the sleeve and supporting bracket, respectively, and thus locks the sight in position.

TANGENT AND FORE SIGHT, MARK II.

A *Mark II* tangent and fore sight have been introduced for future manufacture which differs from the *Mark I* as follows :—

The bar of the tangent sight is solid and is not provided with a toothed rack but is free to slide in a rectangular hole in a bracket provided with a clamping screw with handle by means of which the bar is clamped at the required graduation.

The fore sight is not provided with a jacket and sleeve and is held in position in the bracket by a split pin with chain.

SIGHT, DIAL, No. 7.

(*Plates XVIII and XIX.*)

The No. 7 dial sight is employed for both direct and indirect laying. The upper part can be revolved horizontally through a complete circle independently of the eyepiece, thereby allowing the layer to see an object in any direction without moving the position of his eye. Owing to the height of the sight the layer can lay on objects directly behind him, the line of sight being above his head.

Mark III.—The optical arrangements are so designed that an object viewed through the sight is always seen erect. They consist of :—

F, the *upper prism*, which is mounted in the upper portion of the sight. Its face can be turned in any direction with reference to the eyepiece K, the angle between the two being indicated on the dial plate A by means of a reader on the bracket N.

G, the *centre prism*, which, by means of bevel gearing, is made to revolve at half the speed of the upper prism F; this arrangement ensures the object layed on always appearing erect.

H, a double reflecting roof prism.

J, the object glass.

K, the eyepiece, with two eye lenses.

M, a glass diaphragm, upon which are engraved vertical and horizontal lines, with gaps near their centres; a radium dot is placed just below the optical centre on the vertical graticule and is for use at night.

A glass window in the eyepiece allows the lines to be illuminated at night.

The magnification of the system is 4-diameters and the field of view is 10-degrees. There are no arrangements for focussing the sight.

The principal mechanical parts are the following :—

B, the *supporting pillar*, in which are suitably mounted the eyepiece K, fitted with a dermatine eyeguard, the lower prism H and the object glass J. The “plug, supporting pillar” V is screwed in to its lower end and on it is a castellated nut, which is prevented from unscrewing by a split pin. Near the upper end of the supporting pillar is a coned seating W, which fits accurately on to a coned bearing on the carrier.

The projection X, which fits into a slot in the carrier, prevents the sight revolving and is also the means by which the dial sight is adjusted for line when in use with carriers fitted with dial sight adjusting screws and lock nuts.

C, the *worm-wheel bracket*, is firmly secured to the supporting pillar B. In it is mounted the slow motion traversing gear, which consists principally of a worm spindle S, the worm on which engages with the worm-wheel D. On either end of the spindle is mounted a milled head and an adjustable micrometer scale drum. The drums are graduated in opposite directions in divisions of 10-minutes, *right* angles being denoted by white lines on a black background and *left* angles by black lines on a brass background. For future manufacture the distinctive marking will be omitted, the graduations being filled in with black wax on a bright metal background, *right* angles being indicated by the letter “R” and *left* angles by the letter “L” (see Plate XVIII). The drums can be adjusted by loosening the caps inside the milled heads and turning them independently of the milled heads. The readers for the drums are on the worm-wheel bracket. Each turn of the worm spindle moves the upper part of the sight through 5-degrees. The worm spindle is mounted in an eccentric, which when turned by raising a lever near the left drum throws the worm out of gear with the worm-wheel. This enables the upper part of the sight to be revolved rapidly.

The rear surface and four screws are for the attachment of the upper portion of the deflection bracket of the No. 1 Special and Nos. 2, 4 and 5 dial sight carriers, but in future manufacture carriers will not be provided with deflection brackets and all deflection angles will be applied through the dial sight.

D, the *worm-wheel*, has teeth cut on its lower portion, which engage with the worm spindle S. It extends upwards and is firmly secured to the upper prism holder E and the dial plate A by screws, &c.

Y, the *centre prism holder*, fits accurately in the supporting pillar B. To it is attached the prism mount P, in which the centre prism G is firmly held.

The prism holder is free to revolve and is forced to do so at half the speed of the upper prism holder E, by means of three bevel wheels. The axis of the vertical bevel wheel Z is formed on a projection from the prism holder. This wheel engages with the lower bevel wheel Z¹, which is fixed to the supporting pillar and also with the upper bevel wheel Z², which is fixed to the upper part of the sight. When the upper part of the sight is revolved the axis of the centre bevel wheel and consequently the central prism, are forced to revolve at half the speed of the upper part of the sight.

E, the *upper prism holder*, as previously mentioned, is rigidly attached to the dial plate and worm-wheel. In it are suitably mounted the upper prism and a glass window.

A *Mark I* diaphragm is hinged to the case of the upper prism holder, by means of which the focus and parallax at short distances can be corrected without any appreciable loss of light. The diaphragm, which is fitted with a shutter, is only for use at short distances of approximately 20-yards or under. A spring is provided which retains the diaphragm in position when closed. In the centre of the diaphragm is a hole $\cdot 25$ -inch diameter and in the shutter one of $\cdot 125$ -inch diameter. If the object to be viewed is only a few feet away the shutter is to be used and the object viewed through the small hole. When the dial sight is used at a distance of more than 20-yards the diaphragm is to be lowered from the front of the window.

The *Mark II* diaphragm differs from the *Mark I* principally in the following particulars:—

The hinge pin is of strengthened pattern. The shutter can be operated from the outside, instead of it being necessary to lower the diaphragm. The spring retaining the diaphragm is of an improved design and also retains the shutter.

To enable the line of sight through the upper prism to be elevated or depressed, a small toothed arc is attached to the mount of the prism. The teeth of this arc engage with a worm spindle R. At the top of this spindle are mounted a milled head and adjustable drum, engraved with a zero mark. The reader is engraved on the prism holder; 17-degrees elevation or depression can be given. The letters "E" and "D" are engraved against each numbered graduation to denote Elevation and Depression respectively.

A crosshead with open sights (or view finder) is mounted on the right side of the upper prism holder. Its movement is regulated by that of the upper prism, but as the latter has a reflecting surface the former has to move twice as quickly. This is arranged for by a toothed

wheel on the prism mount gearing with a toothed wheel, having only half the number of teeth, on the pivot of the crosshead with open sights.

Engraved on the under portion of the crosshead is a zero mark, indicated by an arrow on the upper prism holder.

A, the *dial plate*, as previously mentioned, is firmly fixed to the worm-wheel and upper prism holder. The dial plate is cast with two-lug pieces on it to prevent any play between the dial plate and the case upper prism holder. Two scales, each reading from 0 to 180 in single degrees, are engraved round the dial plate, *right* angles being denoted by white lines on a black background and *left* angles by black lines on a brass background. For future manufacture the distinctive marking will be omitted, the graduations being filled in with black wax on a bright metal background, *right* graduations are indicated by the letter "R," the *left* by the letter "L." The graduations are read by a reader on the reader bracket N. This reader can be adjusted by loosening two screws in its rear surface and moving it to one side. The amount of adjustment that can be thus obtained is approximately $1\frac{1}{2}$ -degrees on either side of zero, but instructions will shortly be announced in List of Changes for this adjustment to be increased to 2-degrees for existing sights whilst sights of future manufacture will have an adjustment of $2\frac{1}{2}$ -degrees either way.

The *Mark II* sight differs from the *Mark III* as follows :—

- (1) The dial plate is not cast with two lug pieces on it.
- (2) The slope of the dial plate is steeper, which causes the reader plate to be slightly lower.
- (3) The boss on the top of the dial plate is slightly smaller in diameter, necessitating a smaller clamping collar and lead lining.
- (4) The vertical scale graduations on the upper prism holder crosshead and the micrometer head, excepting the zero and index marks are omitted.

The *Mark I* sight differs from the *Mark II* in the following particulars :—

One of the milled heads on the worm spindle is smaller.

A vertical scale, with graduations to 15-degrees elevation and depression, is fixed to the upper prism holder and the micrometer scale drum is graduated in intervals of 10-minutes.

Certain internal parts are of steel instead of bronze.

Marks I and *II* sights are brought up to *Mark III* type when passing through Woolwich for repair.

CARE AND PRESERVATION OF SIGHT, DIAL, No. 7.

The No. 7 dial sight, when issued, is in correct adjustment, water-tight and all the cells and joints secured by screws. It is very unlikely that the interior will be required to be cleaned and the dial sight must on no account be taken to pieces except by persons in possession of a certificate from the Artillery College stating that they are qualified to do so. The body of the dial sight must be cleaned with a clean, soft cloth and a little oil, which must be rubbed off afterwards, care

being taken that the glass is not touched. The exterior of eye lens and window should be cleaned with a silk cloth or chamois leather, which must be kept perfectly dry and clean and be used for this purpose only.

Dermatine or rubber eye-guards should not be unnecessarily exposed to extremes of temperature, to the sun's rays, or to bright light.

Oil and grease will inevitably destroy rubber or dermatine, and prolonged contact with benzole, petrol and chemicals is undesirable. If, however, oil or grease gets on the eye-guard, it should be immediately removed, either

- (a) By wiping with a clean rag soaked in benzole or petrol.
- (b) By washing in water to which a little soap and soda have been added.
- (c) By wiping off with a clean dry rag.

Spare eye-guards should be stored in a box completely filled with French chalk (so as to exclude air). The eye-guards should be packed in such a way that they are not distorted. If French chalk is not available the eye-guards should be kept under water.

If after being in store for some time the eye-guards lose their pliability they can generally be rendered supple when required for use by steeping them in warm water.

The No. 7 dial sight should be removed from the carrier before travelling any distance and when not in use must be kept in the case provided for the purpose.

SIGHT, DIAL, NO. 1, MARKS I* AND II.

(Plate XVII.)

The dial sight consists of a circular carrying plate with degree scale ring, a crosshead and pin and a sight plate with pointer. The carrying plate is hinged at the centre to the crosshead and the crosshead is hinged transversely to the crosshead pin. This arrangement admits of an adjustment right and left to compensate for any difference that may occur in level of the wheels and for elevation or depression being given to the plate and sight. The degree scale ring is fixed to the periphery of the carrying plate by screws; it is marked in degrees (white on black for right side and black on brass for left), 180 on each side of zero, the required angle being read by means of a pointer fixed to the rear end of the sight plate. Should it be found, by examination, that when the sight line and axis of the gun are parallel, zero is not indicated, the pointer is so formed as to admit of the required adjustment being made. The sight plate is pivoted to the centre of the carrying plate and jointed near its centre; the joint pin is provided with a thumb nut for clamping the plate in the extended or folded position; the plate is fitted with an acorn-pointed foresight at the front end and notched to form a hindsight at the rear end. A clamping screw is provided to fix the sight plate at the required angle. The sight is fixed to the bracket by the crosshead pin, which fits into a corresponding socket on the supporting pillar and is secured by a keep pin.

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CARRIER, NO. 7 DIAL SIGHT, NO. 6, MARKS I AND I*.

(Plates XX and XXI.)

The *Mark I* carrier is attached to the left side of the cradle and consists of the following principal parts :—

Bracket, elevating arc
 „ supporting
 „ deflection
 „ sight socket
 Arc, elevating

The elevating arc bracket is hinged about its centre to the supporting bracket, the lower ends of the brackets being connected by a cross levelling gear, by means of which the carrier is adjusted to compensate for difference in level of wheels. The elevating arc works in a rectangular slot in the elevating arc bracket. Teeth are cut on the rear surface of the arc, which engage a worm mounted in the bracket. The arc is raised or lowered by revolving a pear-shaped handle attached to the worm. An elevation scale plate is provided for use with 8 c.r.h. shells and is graduated from 0 to 23-degrees 30-minutes. The scale is read by a bar, which is pivoted at one end to the bracket, the other end being provided with an index which coincides with a muzzle velocity scale attached to the bracket. The bar can be fixed at the required muzzle velocity by a clamp working in a radial slot. The M.V. correction scale, for use with 8 c.r.h. shell, is graduated in multiples of 5 f.s. and reads from 1875 to 2085 f.s., but in future manufacture the M.V. correction scale will be graduated in alterations of muzzle velocity from the normal and not in actual muzzle velocities as heretofore. The scale reads to 80 f.s. above and 120 f.s. below the normal in multiples of 5 f.s. and the normal position is denoted by the word "normal" engraved on the plate. By this arrangement alterations in muzzle velocity can be compensated for automatically at all ranges. The lower edge of the reader bar is waved to distinguish it from the reading edge.

The deflection bracket is secured to the upper end of the arc. The rear end of the bracket is provided with a traversing screw in two parts and two milled heads having right and left deflection drums, respectively, graduated in 5-minute divisions and with left and right deflection scale plates each graduated to 5-degrees.

In future manufacture, the carrier will be simplified by the omission of the deflection bracket, and in the case of existing carriers the deflection bracket will be locked by means of two screws, the holes for which are drilled through the deflection bracket partly into the traversing screw and tapped in the latter to suit the screws, so that deflection cannot be applied to the dial sight through the carrier. The deflection scale plate, arrow plate, heads and drums of the traversing screw are removed. Carriers so modified will in future be known as "Carrier, No. 7 dial sight, No. 6, Mark I*."

A plate is attached to the deflection bracket, which carries a longitudinal level (sight clinometer), consisting of a cradle with a worm spindle and a toothed arc with a spirit bubble. The cradle is furnished

on its upper side with radial grooves in which the arc works. The worm spindle passes through the centre of the cradle and is provided at each end with an adjustable micrometer collar marked to read minutes in multiples of 5. The arc consists of a toothed segment with a spirit level; it slides in the grooves in the cradle, and the teeth engage with the worm on the spindle. Wear in the bearings is taken up by a spring which presses a bearing piece against the spindle. The spring is attached to the bottom of the cradle. A degree scale, graduated to 10-degrees either side of zero, is engraved on the cradle and is read by an adjustable reader on the arc.

The sight socket bracket is pivoted vertically to the top of the deflection bracket and is secured in position by a nut and keep pin. The bracket is furnished on the under side with a worm rack, gearing with the traversing screw of the deflection bracket and on the rear with an arc with indicating arrow for use with the deflection scale plates. A socket for the reception of the No. 7 dial sight is formed at the rear of the bracket and is provided at the lower end with a catch pin for securing the dial sight in position.

To compensate for drift, the carrier is set at a permanent angle of 2-degrees 20-minutes to the left and a permanent right deflection of 3-minutes.

To use the carrier.—The gain or loss of M.V. with full and reduced charges is calculated as in the specimen calibration form given in the Range Table.

With full charges and 8 c.r.h. projectiles the M.V. reader is set to the figure for gain or loss of M.V.

With reduced charges (6-lbs. 6-ozs.) and 8 c.r.h. projectiles, the actual gain or loss of M.V. with this charge must be multiplied by the factor 1.13 and the M.V. reader set at the figure thus obtained.

NOTE.—It is necessary to calibrate the gun with each charge and projectile in use as there is no known connection between the gain or loss of M.V. in each case.

INSTRUCTIONS FOR TESTING AND ADJUSTING.

Carrier, No. 7 Dial Sight, No. 6.

The field clinometer, longitudinal level (sight clinometer) and elevation scale should be tested daily and after prolonged firing. The alignment tests should be carried out as often as possible.

Any adjustment to optical instruments must be carried out by a qualified artificer.

Before beginning the tests the following preparations should be made:—

- (i) Place the carriage on a firm platform, manipulate it until it is level transversely, and place a shell in the chamber to take up play in the elevating gear.
- (ii) Select a well-defined object at least 1,500-yards distant on which to lay.

- (iii) If this distant object cannot be found, set up the target testing sights (*see* Plate XXII) about 50-yards in front of the gun at right angles to the axis of the bore.
- (iv) If the carriage cannot be levelled transversely the tops of the dial sight carrier and the target testing sights should be sloped to the same angle as the carriage.
- (v) Fix crosswires at the muzzle of the gun.†
- (vi) Set the elevation scale and the cowl of the dial sight at zero; set the dial plate and micrometer scales of the dial sight at 3-minutes left deflection (true zero). Set the muzzle velocity pointer at zero.

Test 1.—To test and adjust the field clinometer.

Set the clinometer at zero, place it on the clinometer plane and elevate or depress the gun until the bubble is in the centre of its run; then turn the clinometer end for end.

If the bubble is still in the centre of its run the clinometer is in adjustment.

If the bubble is not in the centre of its run bring it so by moving the slider or, if necessary, the arm and slider. One-half of the nett reading is the index error of the clinometer.

If the bubble cannot be brought to the centre of its run by this method, the error of the clinometer may be determined by comparison with a clinometer of known error.

To eliminate an error, the clinometer must be adjusted by a qualified person.

Test 2.—To test and adjust the carrier and longitudinal level for elevation.

With the gun laid horizontal and the longitudinal level, muzzle velocity pointer and elevation scale reading zero, the top bearing surface of the carrier should be level longitudinally and the bubble of the longitudinal level should be in the centre of its run.

Set the field clinometer at zero and place it on the clinometer plane of the gun, bring the bubble to the centre of its run by the elevating handwheel. Set the longitudinal level, muzzle velocity pointer and elevation scale at zero. Set the field clinometer at zero and place it longitudinally on the upper bearing surface of the carrier. The bubbles of the field clinometer and the longitudinal level should each be in the centre of their run.

If the bubbles are not in the centre, adjust as follows :—

- (i) *Carrier*.—Slacken the two fixing nuts on the worm-spindle bracket. Remove nut from eccentric stud and shift the sight up or down as required, by the eccentric stud at the front of the worm-spindle bracket. When accurately laid, tighten up fixing nuts and nut on eccentric stud. The eccentric stud has a check screw which must be eased off before turning and tightened after adjustment.
- (ii) *Longitudinal level*.—Bring the bubble to the centre of its run by turning the micrometer head. Slacken the nuts

† The crosswires must be removed on completion of test otherwise accidents may occur when firing.

securing the micrometer scales and the screws securing the reader of the degree scale; shift the micrometer scales and reader to zero and re-clamp.

Test 3.—To test and adjust the dial sight for line.

NOTE.—In practice tests 3 and 4 are carried out simultaneously.

The line of sight through the dial sight should be parallel to the axis of the bore as regards line.

Place the No. 7 dial sight in position. Lay the bore on the distant object for line by the elevating handwheel and the traversing gear, using the intersection of the crosswires as a foresight and the axial vent as a hind sight. The line of sight through the dial sight should be on the distant object. When using the target-testing sights lay the bore on point B; the dial sight should be on point D.

If the dial sight is not in alignment, turn the micrometer heads of the dial sight until the line of sight is correct, slacken the screws securing the reader of the dial plate and the nuts of the micrometers, shift the reader and micrometer scales to three minutes' left deflection and re-clamp.

Test 4.—To test and adjust the dial sight for elevation.

The line of sight through the dial sight should be parallel to the axis of the bore as regards elevation when the muzzle velocity pointer carrier and dial sight elevation scales are at zero.

Lay the bore on the distant object for elevation by the elevating handwheel. The line of sight through the dial sight should be on the distant object. When using the target-testing sights lay the bore on point B; the dial sight should be on point D.

If the dial sight is not in alignment, revolve the milled head at the top of the sight until the line of sight is correct, slacken the nut securing the micrometer collar, revolve the latter to zero and re-clamp.

NOTE.—After adjusting the micrometer collar of the cowl of the dial sight the arrow on the viewfinder will not be opposite zero; if confusion is likely to arise, this arrow should be erased and a new one scribed opposite the zero mark.

MISCELLANEOUS STORES.

BIT, VENT, 14-INCH.

This is of round tempered steel, furnished with a spiral bit at one end and hardened at the point; the opposite end is formed into a loop for convenience in handling. It is used for removing obstructions from the vent channel.

BORER, VENT AXIAL, .303-INCH CHAMBER.

The borer is of steel, shaped to suit the chamber for "Tube, percussion, S.A. Cartridge." The front end of the borer is serrated for removing obstructions of a hard nature from the tube chamber, the other end of the borer is provided with a cross-handle.

BOX, OBTURATING PAD AND DISCS, B.L. 60-PR.

The box is of tin and holds one pad and one set of discs.

CAP, SPONGE, No. 9.

The cap is of waterproof canvas formed to fit over the "head, rammer and sponge."

CASE, CLEANER, No. 8 OR 8A.

The case is of waterproof canvas formed to hold the cleaner with lanyard and lead ball. A leather strap, 1-in. by 36-in., is attached to the centre of the case for securing it to the carriage.

CASE, No. 7 DIAL SIGHT, No. 1.

A stout leather case with internal cork fittings is provided. It is suitable for either the *Mark I*, *Mark II* or *Mark III* sight, except that the fittings which press against the milled heads of the traversing gear must be reduced in thickness when used for a sight with the longer pattern milled heads.

Care must be taken when removing the sight from its case that no strain is put on the dial plate.

CLEANER, PIASABA, No. 17.

The cleaner consists of a piasaba brush fixed on the middle portion of a lanyard. A lead ball is attached by white line to one end of the lanyard so as to carry it through the bore of the gun.

COVER, BREECH.

The cover is of waterproof canvas and is formed to protect the breech portion of the gun, to which it is secured by a strap fixed to the cover.

COVER, BUFFER AND SIGHT BRACKETS.

The cover is of waterproof canvas and is formed to protect the hydraulic buffer and other important parts of the carriage cradle. It is secured in position by straps and buckles fixed to the cover.

COVER, MUZZLE, No. 4.

The cover is made of waterproof canvas shaped to suit the muzzle of the gun. It is provided with a leather strap to secure it in position.

DRIFT, No. 12.

The drift is of steel, and is for use in removing and replacing the breech fittings.

HEAD, RAMMER AND SPONGE.

The head is of sabicu protected in front by a brass ring, and the circumference is provided with tufts of wool. The heads are issued without staves, the latter being provided and fitted locally. The stave is attached to the head by a copper rivet.

The wool tufts will be reduced in diameter by clipping when it is found that the head of the rammer is so tight a fit in the chamber of the gun as to interfere with ramming home the projectile.

IMPLEMENTS, AMMUNITION.—KEY, No. 5.

This key is made of steel and has two hexagonal holes in it to suit the cap of the T and P fuze for setting purposes, also an arm with a projecting pin to insert in the hole in the flange of the fuze-body when fixing the fuze. A projection is provided on the side for inserting in the square recess of plugs.

IMPLEMENTS, AMMUNITION.—KEY, No. 17.

This key is for fixing Nos. 88 and 188M fuzes. The *Mark II* is made of steel, single handled with a circular end bevelled on the underside to suit the fuze, and is provided with a projection to engage in the square slot in the flange of the fuze-body.

IMPLEMENTS, AMMUNITION.—KEY, No. 18, MARK IV.

This key is for use in setting Nos. 88 and 188M fuzes.

The *Mark IV* is made of steel, and is similar in shape to the No. 17, but is provided with a prong on its underside to engage with the stud on the lower time ring; two slots in the handle are also provided in order to assist in the removal of the tin plate cover of certain fuzes, the end of the tear off slip being passed through the slots. It is fitted with a white cotton lanyard.

The *Mark III* key differs from the *Mark IV* in being forged instead of being pressed from mild steel.

IMPLEMENTS, AMMUNITION.—KEY, No. 32, MARK I.

This key is alternative to the No. 17, Mark II key, to which it is similar except that it is double-handled, and the projection for fixing the fuzes is made separately of hardened steel, wedge-shaped and driven into the key, instead of it being formed solid in the key.

It is heavier and stronger than the No. 17.

IMPLEMENTS, AMMUNITION.—KEY, No. 48, PLUGS, AND No. 88 FUZES.

This key consists of a plain bar of steel, 10-inches long, $\frac{3}{4}$ -inch wide, having the ends slightly rounded off. It is for use in removing or inserting plugs having suitable slots, also with the slotted cap of the Fuzes Nos. 88 and 188M.

IMPLEMENTS, AMMUNITION.—KEY, No. 53, MARK III, 2-INCH
PERCUSSION FUZES.

This key is made of steel and is for use with 2-inch percussion fuzes, for H.E., gas or powder filled shell, and for adapter, 2-inch fuze-hole, No. 2.

Each end is semicircular in shape, having the inner edge chamfered and a projection formed to engage in the slot provided in the fuze for the purpose.

IMPLEMENTS, AMMUNITION.—KEY, No. 59, MARK I.

This key is for use in removing G.S. fuze-hole plugs, also for G.S. special and 2-inch fuze-hole plugs except 2-inch, No. 3, Marks IV and V and No. 8.

It is made of steel. It is double-handled, and consists of a 15-inch round bar passing through a centre portion having a circular base recessed to fit over the plugs, a projecting rib being formed across the centre of the recess to engage in the key slots on the top of the plugs.

A slightly tapered square projection is formed on the top of the centre portion for use with plugs having square recesses.

IMPLEMENTS, AMMUNITION.—KEY No. 69, MARK I.

This key is used for removing or inserting "Adapters, 2-inch fuze hole, Nos. 10 and 12."

It is T-shaped and double-handled and consists of a 21-inch length of $\frac{3}{8}$ -inch gas pipe passed through a circular steel holder and secured by a screw; the underpart of the holder is slotted to receive key pieces, to suit the adapters, which are secured by a washer and two screws.

The key pieces are bridge-shaped and have projecting studs on their underside to engage in the slots in the adapter with which they are used. For Nos. 10 and 12 adapter, key pieces "D" and "E" respectively are required.

INDICATOR, FUZE, B.L., 60-PR.

The No. 1 *Mark I* fuze indicator is of delta metal or M.B. and consists chiefly of a base plate, reader, fuze slide, corrector scale plate and clamping handle.

A range scale is engraved on the upper part of the base plate and reads from 2,500 to 9,400 yards, in multiples of 25 yards, every 100 yards being numbered. The scale is read by a reader, which can be moved along the top edge of the plate by hand and held in position at the range ordered by means of a spring and tension screw. A stop screw, at each end of the plate, prevents the reader from slipping off and becoming lost.

A movable corrector scale plate is attached to the lower part of the base plate by two screws passing through elongated slots at each end of it. The upper edge of the plate is graduated with a fuze corrector scale reading from 0 to 200, in multiples of 10 (150 being the normal) and is read by an arrow head on the fuze slide. At the lower edge of the plate is a M.V. corrector scale graduated in multiples of 10 f.s. reading from 1850 to 2100 f.s., 2080 being the normal. The M.V. scale is read by an arrow head on the clamp and is chiefly for the purpose of correcting variations in muzzle velocity of individual guns, due primarily to wear. The corrector plate is clamped in the required position by its screws.

The centre of the base plate is grooved to take a fuze slide, which is graduated in fuze settings to suit the No. 83 T. and P. fuze.

The indicator is provided with two hooks for the purpose of hanging it in a convenient position when in use.

To use the indicator set the muzzle velocity on the M.V. scale and clamp it, move the slide until the arrow head coincides with the corrector ordered, and clamp it by means of the clamping handle. Set the reader at the range ordered, and the fuze point to the left of the straight edge of the reader will be the correct length of fuze to employ.

The No. 2 *Mark I* fuze indicator differs from the No. 1 *Mark I*, in that it is fitted with a reversible slide graduated on both sides; one side being in fuze settings to suit the No. 83 T. and P. fuze and the other the Nos. 65 and 65A T. and P. fuzes.

The No. 4 fuze indicator is of delta metal and consists chiefly of a base plate, reader, reversible fuze slide, corrector scale plate and clamping handle.

An elevation scale is engraved on the upper part of the base plate and reads from 1 degree 30 minutes to a maximum of 36 degrees, in multiples of 10 minutes, every whole degree being numbered. The scale is read by a reader, which can be moved along the top edge of the plate by hand, and held in position at the estimated elevation by means of a spring and tension screw. A stop screw at each end of the plate prevents the reader from slipping off and becoming lost.

A movable corrector scale plate is attached to the lower part of the base plate by two screws passing through elongated slots at each end of it. The upper edge of the plate is graduated with a fuze corrector scale reading from 0 to 200, in multiples of 10 (150 being the normal) and is read by an arrow head on the fuze slide. At the lower edge of the plate is a M.V. corrector scale graduated in multiples of 25 f.s. to 75 f.s. above and 175 f.s. below normal, the normal position being indicated by the word "normal" engraved on the plate. The M.V. scale is read by an arrow head on the clamp and is chiefly for the purpose of correcting variations in muzzle velocity of individual guns, due primarily to wear. The corrector scale is clamped in the required position by its screws.

The centre of the base plate is grooved to take a reversible fuze slide, both sides of which are graduated in fuze settings to suit the No. 88 T. and P. fuze when used with 8 c.r.h. shell. One side being for "full" and the other for "reduced" charges.

The indicator is provided with two hooks for the purpose of hanging it in a convenient position when in use.

Strips, Range, B.L. 60-pr. Fuze Indicator.

The No. 1 *Mark I* range strip is of enamelled tin and is formed to fit over the No. 2, *Mark I* fuze indicator under the reader. It is graduated from 4,200 to 15,000 yards to suit the No. 88 T. and P. fuze with 8 c.r.h. shell in conjunction with the No. 83 fuze side of the slide.

Paper range strips have been adopted for use with the Nos. 1 and 2 fuze indicators. The strips are graduated to suit various combinations of ammunition as indicated below in conjunction with the No. 83 fuze side of the slide.

Range Table.	Strip.	Range Graduations.	Combination of Ammunition.
40/W.O./6465	A	4,600 yards to 15,000 yards ...	8 c.r.h. projectile. No. 88 fuze. Full charge.
40/W.O./6962	B	4,200 yards to 13,700 yards ...	8 c.r.h. projectile. No. 88 fuze. Reduced charge.
40/W.O./7498	C	3,800 yards to 12,000 yards ...	2 c.r.h. projectile. No. 88 fuze. Reduced charge.
40/W.O./6040	D	4,100 yards to 13,600 yards ...	2 c.r.h. projectile. No. 88 fuze. Full charge.

Strips, Fuze Scale, Paper, B.L. 60-pr., No. 4 Fuze Indicator.

The undermentioned *paper* fuze scale strips have been adopted for use with the No. 4 fuze indicator, they are graduated for the following purposes :—

Range Table.	Strip.	Combination of Ammunition.
40/W.O./6040 	A	2 c.r.h. projectile. No. 88 fuze. Full charge.
40/W.O./7498 	B	2 c.r.h. projectile. No. 88 fuze. Reduced charge.

LANYARD, FIRING, No. 33.

(Plate V.)

The No. 33 firing lanyard is of flexible steel wire rope, 6-feet long with steel wedge fork and toggle. Two studs are provided in the side of the fork, which also serves as a tool in assembling and dismantling the striker spindle.

MAT, PROTECTING, RUNNING OUT PRESS.

This mat is constructed of manilla rope, and is formed with clearances at the sides for the fore, tangent and oscillating sights, and two port holes at the top to enable access to be obtained to the air and filling plugs when the mat is in position on the carriage. Two flaps

are provided to cover the port holes, and rope lashings are provided for securing the mat to the carriage, the fore portion to the spring cases and the rear portion to the eyes fitted to each side of the cradle.

RIMER, VENT AXIAL, .303-INCH CHAMBER, No. 2.

The rimer is of bronze and steel, the bronze portion being shaped to suit the chamber for "Tube, percussion S.A. cartridge," and having flats formed on it for removing residue from the chamber.

SLING, GUN AND CARRIAGE, B.L. 60-PR.

The sling is for use when embarking and disembarking the gun and carriage. It is made up in three parts and is of steel wire rope; one end of each part is provided with rings and links for lifting purposes, and the other end of two parts is formed with a loop to fit over the end of the axle tree, whilst the third part is provided with a shackle for attachment to the trail eye.

WRENCH, BREECH MECHANISM, No. 52.

The No. 52 wrench is of steel, forked at one end, for use with the nut of the axial vent, and provided at the other end with a spanner for nuts of carrier hinge bolt and breech mechanism lever stud. A cross-handle is formed on the wrench, provided with screwdriver ends for use with screws and axis pins.

WRENCH, BREECH MECHANISM, No. 173.

The No. 173 wrench is of steel and is for use in conjunction with No. 199 B.M. wrench with the nut on the front end of the vent bush spindle.

WRENCH, BREECH MECHANISM, No. 199.

The No. 199 wrench is of steel having at one end a spanner to suit the nut of the vent bush spindle in the vent and provided at the other end with a bronze end piece secured by rivets for use when assembling and dismantling the "V" slide box.

DIMENSIONS, WEIGHTS, &C.

Dimensions.

DIMENSIONS, WEIGHTS, &c.										Mark I carriage and Mark I limber.	Mark III carriage and Mark II* limber.
<i>Dimensions.</i>											
Carriage—										ft. ins.	ft. ins.
Height	{ to axis of gun									4 4.4	4 1
	{ of dial sight line									6 5.9	6 2
	{ of fore and tangent sight line									5 6.9	5 3.5
	{ without sights									5 8	5 4
Width (maximum)										6 6.5	6 7.5
Length, trail on ground, firing position { with gun										21 7	21 2
										without gun	16 5	16 3.5
Limber—											
Height										5 0	5 0
Length	{ with pole									16 5	15 4
	{ without pole									7 1	6 5
	{ of axletree with dust caps									6 6.5	6 7.5
Width	{ outriggers extended									9 9	9 2
	{ outriggers folded									7 0	6 5
Carriage and limber—											
Length	{ with gun in travelling position { without pole (limber horizontal)									23 6	24 0
	{ with pole									32 4	32 7
	{ with engine draught connector									26 3	—
	{ with gun in firing position { without pole (limber horizontal)									28 6	28 8
	{ with pole									37 4	37 5
	{ with engine draught connector									31 2	—
between axletrees										13 11	14 1
Wheels	{ track									5 2	5 2.5
	{ diameter									5 0	5 0
Space required to turn in (diameter of circle)										54 0	60 0
										degs. mins.	degs. mins.
Upsetting angle	{ carriage									33 0	{ 19 30†
	{ limber									43 0	{ 23 30§
Upsetting angle of limber with full lock										29 30	—
Angle of lock										37 0	35 0
Elevation (maximum)										21 30	21 30
Depression (maximum)										5 0	5 0

Mark II ammunition wagon and limber—

Height, maximum—										ft. ins.
Limber with guard irons										5 8
Limber with guard irons removed										4 10½
Wagon with guard irons										5 2½
Wagon with guard irons removed										4 5
Width, maximum										6 3½
Length—										
Limber and wagon										22 8½
Limber, wagon { with pole										14 2
{ without pole										5 6
Wagon										9 8½
Between axletrees										8 3
With pole (point of pole on ground)										22 4½
Without pole										13 9½
Greatest projection beyond track of wheels										0 6½

† Without sand felloes.

§ With sand felloes.

DIMENSIONS, WEIGHTS, &C.—*continued.**Weights—continued.**Average weight—continued.**Mark II ammunition wagon and limber—continued.**Limber—*

Weight on pole at position of 3rd tughole from front, with wagon limbered up—

	Cwt.	qr.	lb.
Without men	0	0	14
With 2 men on limber only	0	1	7
With 2 men on limber and 2 men on wagon	0	0	25
Empty (but including loose components)—			
Wagon	15	1	24
Limber	12	2	16
Wagon with limber (limbered up)	27	3	12
Limber only, but with wagon limbered up	13	1	2

*Tonnage—**Mark I—*

	Tons.
Wagon ammunition, without wheels	4.7
Limber wagon, without wheels	3.231
Wheels (4)	1.23

LIST OF STORES.

CARRIAGE.

Articles.	No.	Where Carried.
Bit, vent, 14-in....	1	In holder right side of trail.
Blocks, tackle, G.S., 2½-in. cordage, snatch	2††	In trail.
Brush, breech screw	1	In leather pocket on left actuating brake rod.
Can, lubricating, No. 9...	1	In trail.
Cap, sponge, No. 9	1	On rammer and sponge.
Case, cleaner, No. 8 or 8A	1	On cleaner.
Cleaner, piasaba, No. 17	1	In trail.
Covers { breech	1	On gun.
{ buffer and sight brackets	1	On carriage.
{ muzzle, No. 4...	1	On gun.
Hammer, claw, 32-oz.	1	On right side of trail.
Handspikes, common, 6-ft.	4	In trail.
Pincers, carpenters	1 pair	On left side of trail.
Posts, aiming { circular head	1	
{ diamond head	1†	On right side of trail.
{ square head	1	
Rammer and sponge	1	In trail.
Rimer, vent, axial .303-inch chamber...	1	In holder right side of trail.
{ Adjustable 15-in.	1	On left side of trail.
Spanners { No. 189	1†	On right side of trail.

LIMBER, CARRIAGE.

Articles.	No.	Where Carried.
Bar, supporting draught pole, No. 4 (spare)	1	On diagonal stays, front of limber.
Bolts, stop, yoke band (for use with bullock draught)	2	In off limber box.
Box, grease, 3-lb.	1	Under limber.
Brush, water, carriage	1	In case, under limber.
Buckets, water, G.S.	2	Slung under axletree.
Bush, hinge bolt carrier (spare)	1	In off limber box.
Can, lubricating, No. 10 (a)	1	" " "
Cartridges	2§§	One in each limber box (in tin box).
Case, No. 7 dial sight, No. 1	1	In near limber box.
Clinometer, field (in wood box)	1	In off limber box.
Collar, adjusting, 1st Class B capped wheels	1†	In off limber box.

†† For carriages not fitted with bollards in accordance with para. 17,187 List of Changes.

† Per section.

§§ Only carried here in the case of Mark I limber when the gun has been shifted to the firing position.

(a) Will not be replaced when unserviceable.

LIMBER, CARRIAGE—*continued.*

Articles.	No.	Where Carried.
Covers, rifle	2	On rifles.
Cloths, sponge	6 }	In off limber box.
Cotton waste, coloured... .. ozs.	4 }	
Drift, No. 12	1	In near limber box.
Files—		
Smooth, hand, safe edge, 6-in. ...	1	In near limber box.
Second cut, half-round, 6-in. ...	1	" " "
Handles, file, small	1	" " "
Leather, chamois	1†	In telescopa box "off" limber box.
Lashings, 1-in., 10-ft.	4	In wire net.
Lanyard, firing, No. 33	1	In off limber box.
Padlocks, iron, 2-in., with keys ...	2	On limber boxes.
Pin, linch, 1st Class B capped wheels (spare)	1†	In off limber box.
Pins, keep, split—		
$\frac{3}{8}$ -in. by 4-in. ... (spare)	1	" " "
$\frac{3}{8}$ -in. by 1 $\frac{1}{4}$ -in.	1	" " "
$\frac{3}{8}$ -in. by 1 $\frac{1}{4}$ -in.	1	" " "
Plugs—		
Air hole—		
$\frac{3}{8}$ -in.	1	" " "
$\frac{1}{4}$ -in.	1	" " "
Filling hole, hydraulic buffer, No. 39 (spare)	1	" " "
Pockets, key, spring lock, 2 keys¶ ...	2	On limber boxes.
Pocket, tube, L.S., with strap ...	1	In off limber box.
Rifles, short	2	On board, front of limber.
Ropes, drag, heavy pairs	{ 1	In wire net.
	{ 1	On diagonal stays, front of limber.
Screws, lubricating hole, bosshead, $\frac{3}{8}$ -in. by $\frac{3}{8}$ -in. ... (spare)	2	In off limber box.
Shell, shrapnel	2††	In rear of limber boxes.
Sights—		
Fore	1	In off limber box.
Dial No. 7	1	In case in near limber box.
Tangent (with clamp)	1	In off limber box.
Spanners—No. 264	1†	" " "
Spanners, hydraulic buffer—		
No. 130	1	In off limber box.
No. 131	1	In near limber box.
No. 132	1	In off limber box.
No. 175	1	" " "

† Per section.

¶ Component of limber.

†† Only carried here in the case of Mark I limber when the gun has been shifted to the firing position.

LIMBER, CARRIAGE—*continued.*

Article.	No.	Where Carried.
Springs—		
Catch, retaining—		
Breech mechanism lever (spare)	1	In off limber box.
Breech screw	1	" " "
Stays, outrigger†	2	On limber frame.
Swingletrees, No. 12†	4	" "
" " " (spare)	1	" "
Tallow (in tin box) lb.	1	In off limber box.
Tray, small stores	1	" " "
Vent, axial ... (spare)	1§	" " "
Washer, bearing, hinge bolt carrier (spare)	1	" " "
Washer, drag, 1st Class B capped wheels ... (spare)	1§	" " "
Wrench, adjusting, No. 7 dial sight and carriers	1(a)	In near limber box.
Wrench, breech mechanism, No. 52 ...	1	" " "

† Component of limber.

§ Per section.

(a) Per 3 guns.

MARK II. B.L. 60-PR. AMMUNITION WAGON AND LIMBER.

Articles.	Wagon.	Limber Wagon.	Where Carried.
Axes, pick—			
Heads, 4½-lb. ... ..	...	1 }	On footboard.
Helves, 36-in., ferruled ...	...	1 }	
Bar, supporting draught pole,			
No. 4 ... ..	...	1	"
Blankets	2	3	On top (front).
Boxes, cartridge	24	16	In ammunition box.
Boxes, fuze, No. 33, Mark III ...	2	2	
Boxes, grease, 3-lb. ... {	...	1	Under "Near" side.
Box, lamp, siege, to hold 2 ...	1	...	Under "Off" side.
Box, obturator (with spare pads			On top, "Near" side.
and discs) ... ..	...	1	
Bush, sliding block ... ..	...	1	In "Tray, small stores."
Brush, water, carriage ... ..	...	1	
Bucket, water, G.S., canvas ...	2	...	Under "Near" side.
Can, lubricating, No. 3 ... ..	...	2	In wire net receptacles.
			Under platform board
			"Off" side.
Cartridges	24	16	In ammunition box.
Cloths, sponge ... ..	...	5	In "Tray, small stores."
Collar, adjusting, 2nd Class "C"			
capped wheels ... ..	...	1	" "
Cotton waste, coloured ... oz.	...	2	" "
Covers, rifle ... ..	...	3	On rifles.
Fuzes, percussion, Nos. 101, 101E,			
106 or 106E	12	8	In fuze lockers.
Fuzes, T. and P., No. 88 or 94 (in			
tin cylinders)	12	8	In fuze boxes.
Greatcoats... ..	2	3	On top (rear).
Handspike, common, 6-ft. ...	1	...	With spare pole under
			perch.
Hooks, bill (in case) ... ..	...	1	On "Off" side.
Keys, No. 5†	2	1	In fuze box.
Key No. 10—Set screw, shrapnel			
shell	1	1	" "
Keys, No. 53—Nos. 101 and			
106 fuzes	2	1	
Keys, No. 17 or 32—Fixing Nos.			
88, 188, 94 and 194 fuzes ...	2	1	" "
Keys, No. 18—Setting Nos. 88,			
188, 94 and 194 fuzes† ...	2	2	On side of ammunition
			box.
Keys, No. 59, G.S. and 2-in. fuze			
hole plugs	2	2	
Kettles, camp	2	...	Under wagon.
Lamps, siege	2	...	In box.
Lanyard, firing, No. 33 ... ..	...	1	In "Tray, small stores."
Lashing, tarred, 1-in. ... 10-ft.	2	...	On top at rear.
Link, coupling running out presses	...	1§	In "Tray, small stores."
Marlinespike, steel, 11-in. ...	...	1	
Pin, linch, 2nd Class "C,"			
capped wheels ... ..	...	1	" "
Pliers, flat nose pairs	...	1	" "

† According to fuzes with equipment.

§ Per Section.

MARK II, B.L. 60-PR. AMMUNITION WAGON AND LIMBER—*continued.*

Articles.	Wagon.	Limber Wagon.	Where Carried.
Pole, draught, No. 18, Mark II	1	...	Under perch.
Ropes, drag, heavy ... pair	...	1	On footboard.
Ropes, picketing, 66-ft. ...	1	...	On top (rear).
Rifles, short ... ..	...	3	In clips—front of limber.
Saw, hand, 26-in. (in case) ...	1	...	On "Near" side.
Screwdriver, G.S., 6 in. ...	...	1	In "Tray, small stores."
Shell—			
H.E.	12	8	} In ammunition box.
Shrapnel	12	8	
Shovels, G.S. ... ..	...	2	On platform board.
Spanner, No. 93	1	...	On "Off" side.
Springs, catch, limber hooks ...	...	2	In "Tray, small stores."
Swingletrees, No. 12 or 13 ...	...	1	On footboard.
Tape, measuring, metallic woven, 100 ft. ... ..	...	1	In "Tray, small stores."
Tools, saddlers, No. 1 ... set	1	...	In valise.
Tools, shoeing	1	...	In "
Tubes, S.A. (20 in tin box)	40	20	In fuze boxes.
Valises, horse shoe, large (with 3 sets horse shoes)	1	...	On top (centre).
Valises, tool—			
Saddlers... .. sets	1	...	On top, "Off" side.
Farriers	1	...	On top, "Near" side.
Washer, drag, 2nd Class "C" capped wheels ... ..	...	1	In "Tray, small stores."

DIAGRAM OF PACKING.

A

B.L., 60-Pr., CARRIAGE AND LIMBER.

LIMBER.

1 Water brush
In case (under).

1 pair heavy drag ropes.
1 pole bar.
2 outrigger stays.
5 swingletrees, No. 12.
2 rifles.

4 lashings }
1 pair heavy drag ropes } in
wire
net.

2 buckets, slung under axle-
tree.

1 projectile. 1 projectile.
1 box, grease (under).

CARRIAGE.

1 cover, breech
(on gun).

1 cover, buffer and
sight brackets
(in position).

In Trail.

2 aiming posts.

1 hammer.

1 spanner, No. 189.

1 bit, vent, 14 in. }
1 rimer, vent } in
axial. holder.

1 can, lubricating, No. 9.
1 cleaner, piassaba, with
case.
1 rammer, with cap.
4 handspikes.
2 blocks, tackle, G.S. 2½ in.
cordage, snatch.

1 pair pincers, car-
penters.

1 spanner, adjustable,
15-in.

1 brush, breech screw
(in pocket).

1 cover, muzzle
(on gun).

DIAGRAM OF PACKING.

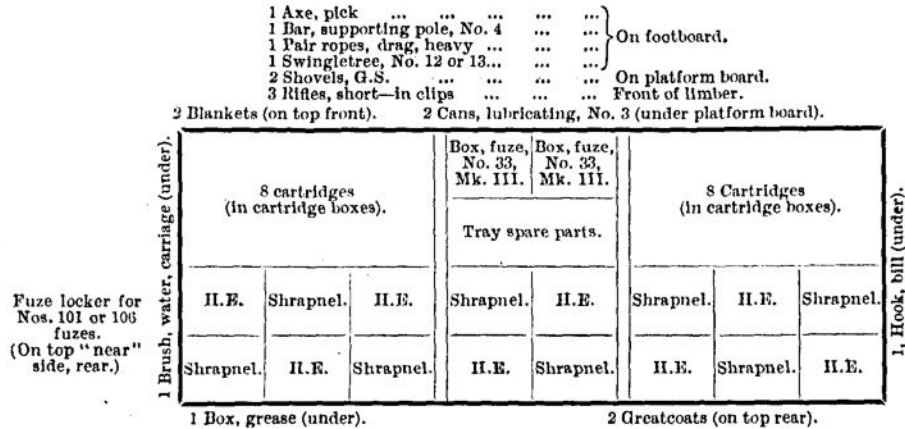
E

B.L., 60-pr.

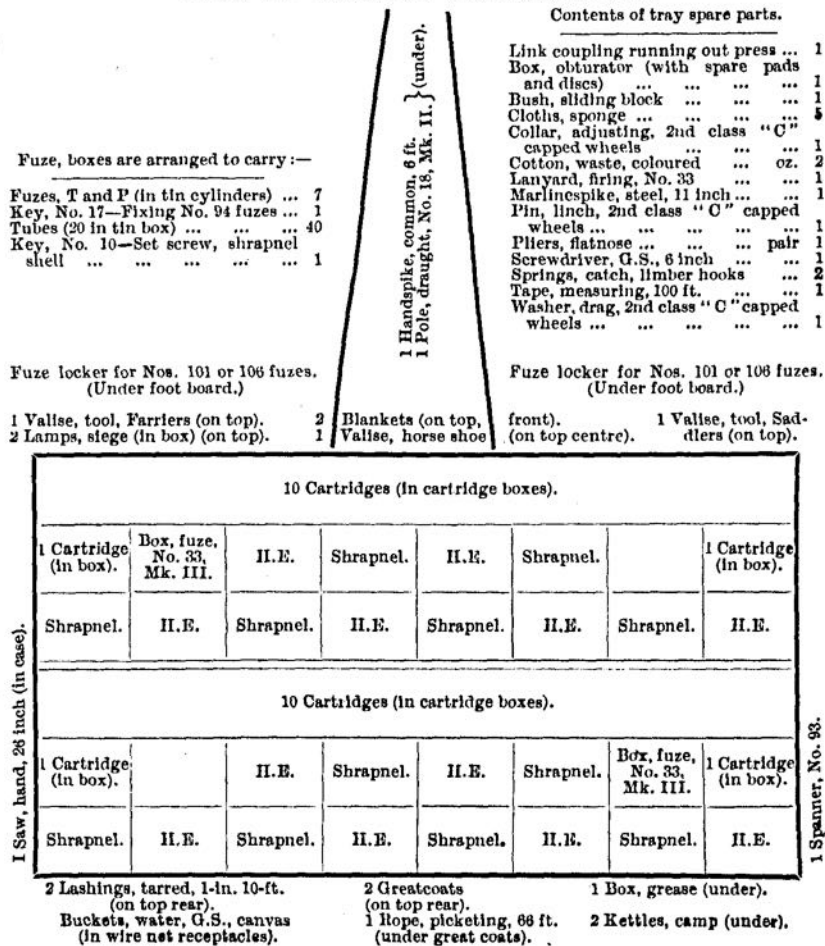
Near.

Mark II.—LIMBER WAGON.

Off.



Mark II.—WAGON AMMUNITION.



AMMUNITION.

Projectiles.					Nature of fuzes.††	Cartridges.			Means of Firing.
Nature.	Mark. (a)	Bursting charge.		Average weight filled and fuzed.		Nature.	Size.	Weight.	
		Nature.	Weight.						
Shell, B.L., High Explosive 60-pr.	IX.C.	H.E.	lb. oz. dr. 6 2 0	lb. oz. dr. 60 0 0	Fuze, Percussion, D.A., No. 106.	Cordite, M.D. or R.D.B.	15	lb. oz. dr. 9 7 0	Tube, Percussion, S.A. Cartridge.
	X.C.	H.E.	6 0 8	60 0 0	Fuze, Percussion, D.A., No. 106 E. Fuze, Percussion, No. 101 E (b). Fuze, Time, No. 188M with No. 12 adapter and No. 2 gaine.†	Cordite, M.D. (c)	16	9 7 0	
Shell, B.L., gas, 60-pr.	V.C.	—	—	60 0 0	Fuze, Percussion, D.A., No. 106. Fuze, Percussion, D.A., No. 106 E. Fuzes, Time and Percussion, No. 88.	Cordite, M.D. or R.D.B.	11	6 6 0†	
Shell, B.L., shrapnel, 60-pr.	IV.C.	Powder.	4 0	60 0 0		Blank, L.G. powder.		3 0 0	

(a) Other marks may be met with.

(b) With No. 2 gaine.

(c) Obsolete for future manufacture.

†† When stock of No. 106 fuze is exhausted it will be superseded by No. 106E.

† For air burst ranging. Only issued when specially ordered.

‡ Reduced charge.

CARTRIDGE, B.L., 60-PR., 9-LB. 7-OZ. CORDITE, M.D. OR R.D.B.,
SIZE 15.

(Plate XXIII.)

The *Mark III* cartridge is made up of either cordite M.D. or cordite R.D.B.

The body of the empty cartridge is made up of silk cloth (or cream serge) one end being sewn to two discs of shalloon, which are divided into four or six parallel compartments, by stitching, to form an igniter when filled with gunpowder.

At the other end, the empty bag has either an "A" or "D" shalloon igniter secured by sewing. The igniters each consist of 16-drams R.F.G.² powder, which in the case of the former is contained in four parallel compartments and in the latter six.

The charge consists of a cylindrical bundle of M.D. or R.D.B. size 15 cordite sticks, 17.25-in. long, tied in four places with No. 1 silk sewing.

CARTRIDGE, B.L., 60-PR., 9-LB. 7-OZ. CORDITE, M.D., SIZE 16.

The *Mark IV* cartridge is made up of cordite M.D. cut about 16.4 inches long.

It is generally similar to the size 15 *Mark III* cartridge described above. It is, however, obsolete for future manufacture.

CARTRIDGE, B.L. 60-PR. 6-LB. 6-OZ. CORDITE, M.D. OR R.D.B., SIZE 11.

REDUCED CHARGE.

(Plate XXIV.)

The *Mark I* cartridge is made up of cordite, M.D. or R.D.B., respectively.

The cartridge consists of 6-lb. 6-oz. cordite, M.D., or R.D.B. size 11, enclosed in a silk cloth or cream serge bag, having an igniter, which consists of 16-drams R.F.G.² powder sewn to each end of the bag.

The charge consists of a cylindrical bundle of size 11 sticks of M.D. or R.D.B. cordite tied in three places with silk sewing.

A red band, 1 in. wide, is painted round the centre of the bag and the marking stencilled in red instead of black to distinguish it from other cartridges.

CARTRIDGE, B.L., 60-PR., 3-LBS., BLANK, L.G. MARK I.

The cartridge consists of 3-lbs. blank, L.G. powder, contained in a No. 1 silk cloth or cream serge bag furnished with four hoops of silk braid and choked with No. 1 sewing silk.

The precautions to be taken when firing blank ammunition are detailed in Appendix VII, Artillery Training, Volume II, 1920.

PACKING.

Cartridges for the 60-pr. are packed 10 Full or 12 Reduced in a "Case, powder, M.L., whole." The full charges can also be packed 10 in a "Box, cartridge, C. 125."

SHELL, B.L., HIGH EXPLOSIVE, 60-PR.

(Plate XXV.)

Mark IXc.—This shell is made of forged steel, with an 8 calibre radius head fitted at the nose with a gunmetal fuze socket to permit of the use of a metal exploder container. The fuze socket is screwed to the 2-inch fuze-hole gauge and is provided with a fixing screw. Alternatively the fuze-hole may be formed in the head of the shell itself. A steel plate disc is screwed in the base, or alternatively a plain steel plate disc is riveted in. A copper driving band is fitted near the base into an undercut groove having two waved ribs, to prevent the band turning on the shell.

Length (maximum)	Inches.
18.93	
Diameter—	
Body (maximum)	4.99
Driving band (maximum)	5.21

Mark Xc.—This shell is made of forged steel and is fitted with a removable head to make it suitable for block filling, the head, which is of 8 calibre radius, being secured by a fixing screw. A fuze-hole socket, to permit of the use of a metal exploder container, is formed in the head proper.

The socket is screwed to the 2-in. fuze-hole gauge.

A 3.375-in. steel plate disc is screwed into a recess in the base or, alternatively, a plain plate disc is riveted in.

A copper driving band is fitted near the base into an undercut groove having two waved ribs.

Length (maximum)	Inches.
18.84	
Diameter—	
Body (maximum)	4.99
Driving band (maximum)	5.21

SHELL B.L. GAS, 60-PR., MARK Vc.

(Plate XXVI.)

This shell is converted from the H.E. *Mark IXc* described above, from which it differs in the head being fitted with a container to take the bursting charge, the latter being threaded internally to the 2-inch fuze-hole gauge.

A tapered charging hole is drilled in the body of the shell below the shoulder and is closed after charging by driving in a steel charging hole plug.

SHELL, B.L., SHRAPNEL, 60-PR.

(Plate XXVII.)

Mark IVc.—The shell consists of a steel body with a solid base and a steel or malleable cast iron head struck with a radius of eight calibres.

The head is threaded to the 2-inch fuze-hole gauge and is secured to the body by eight screws and eight twisting pins, the interior of the top of the body being recessed to form a seating for the bottom of the head. A cylindrical wood block, or alternatively, a shaped composition block, is fitted in the head, a felt washer being placed underneath the block when made of wood.

The interior of the body at the base is recessed to take a tinned plate cup containing a bursting charge of 4·0-ozs. R.F.G.² powder.

The walls of the shell are parallel, tapering off towards the head, and may be lined with brown paper.

The shell contains about 681 bullets (34 or 35 per lb.) set in resin and supported by a steel disc placed over the tin cup. Buckshot or iron shot may be used to regulate the weight.

A metal central tube conveys the flash of the fuze to the bursting charge; the lower end of the tube is screwed into the steel disc, the upper end is soldered or expanded into a recess in the bottom of the fuze-hole socket.

Near the base of the shell a driving band is fitted into an undercut groove having two waved ribs formed in it or, alternatively, the groove is knurled.

				Inches.
Length (maximum)	...	...	...	16·14
Diameter—				
Body (maximum)	...	...	...	4·99
Driving band	...	...	...	5·21

FUZES.

INSTRUCTIONS RELATING TO THE CARE OF No. 106 AND 106E FUZES.

(1) The wire seal is broken and the (safety) cap of the No. 106 or 106E fuze removed *only* immediately prior to loading.

(2) If a No. 106 or 106E fuze has become uncapped in any manner except that referred to in (1) or has had the wire seal inadvertently broken, it is to be regarded as unfit for firing and is to be withdrawn from use.

(3) Fuzes withdrawn, under paragraph (2), are to be examined to ascertain if the brass tape under the hammer head is present and correct, if this is so, the (safety) cap should be replaced and secured in position by a becket, and returned to the Ordnance Store for transmission to Woolwich. If examination shows that the brass tape is incorrect, or missing, the fuze may be in a *dangerous condition* and must be destroyed under expert supervision.

In securing the (safety) cap with the becket, difficulty may arise with fuzes, where the body is not provided with an eye through which the becket may be threaded, in such cases, wooden pegs should be driven into the fixing key holes in the body and the becket fastened round these.

(4) It is essential that the becket should be fastened in such a manner, as to prevent the cap coming off in transit to Woolwich. The method of fastening the fuze-cap is as shown on Plate (XXVIII).

FUZE, PERCUSSION, D.A., No. 106E.

(Plate XXIX.)

The Mark IV fuze consists of the following principal parts: Body, safety cap, hammer, steel collar in halves, copper tape with weight, steel and dermatine washers, copper shearing wire, steel guide pin, detonator holder, detonator, magazine with shutter, shutter spring, bottom screwed cap, shalloon and paper discs.

The *body*, which is made of metal, is screw-threaded externally at its lower end to suit the 2-inch fuze-hole gauge. Its upper end, which is generally conical in shape, terminates in a cylindrical stem, which is screw-threaded to receive the cap. Slots are cut in the body to receive the No. 53 key for fixing purposes. The body is further prepared to receive a shearing wire, guide pin and a countersunk hole to take the wire securing the cap. A groove is cut round the shoulder for punch stabbing the fuze into the shell when fuzing the latter.

Internally the body is bored out in different diameters to receive the hammer, detonator holder and magazine.

The *hammer* is of steel, fitted with an aluminium head. The lower end is pointed to form a needle. Just below the head a recess is bored to take a stud on one-half of the steel collar and in one side a slot is cut through which fits the shearing wire and guide pin. The hammer is placed in position from the top of the fuze body passing through a steel washer on the top of the latter. The guide pin is screwed into the body, one end entering the slot in the hammer. The shearing wire passes through the body and hammer, the ends being afterwards turned over. The function of the guide pin is to prevent the hammer turning whilst the tape is being unwound, while the shearing wire keeps the hammer clear of the detonator after the collar has become detached. Around the hammer, under the head and resting on the steel washer of the body, is a steel collar in halves, one-half of which has a pin to fit the recess in the hammer, and around this again is wound a copper tape to the outer end of which is soldered a weight. The top of the fuze is then closed by a Ω -shaped steel or malleable cast iron cap which screws on to the projection at the top of the body against a dermatine washer, and is held in position by a steel wire which passes through an eye in the cap, the two ends being twisted, a complete turn is then taken round the cap and the loose ends inserted in the hole provided in the body and fixed therein by a lead plug pressed in.

The *detonator holder* is held in position by the top surface of the magazine. Its upper end is recessed to receive the detonator, which is held in position by the mouth of the holder being spun over. A cupro-nickel or brass disc is placed on top of the detonator. An opening in two diameters is bored through the centre of the holder below the detonator, which is filled with loose C.E., the opening being closed by a paper disc shellaced to the bottom of the holder.

The *magazine* is screwed externally to suit the interior of the body and is reduced in diameter near the bottom and screwed to receive the bottom cap. The top of the magazine is recessed and fitted to receive a shutter and spring. The magazine is bored internally in two diameters to within .003 inch of the shutter recess. The smaller bore is filled with loose C.E. whilst the larger bore takes a compressed pellet of C.E. A paper disc separates the loose C.E. from the pellet.

The shutter is of metal, shaped and pivoted to admit of movement when acted centrifugally. It is interposed between detonator holder and magazine, and in the closed position is designed to prevent the detonator functioning the magazine. It is pivoted at one end by an

axis pin, and is retained in the closed position by a coiled spring, sufficiently strong to prevent movement until a rotation of 1,300 to 1,700 revolutions per minute is attained. A hole is bored through that portion of the shutter which is in the central position when the shutter opens, this is filled with loose C.E.

A set screw is screwed into a hole in the body of the fuze and holds the magazine in position.

Preparation of Fuze.—To prepare the fuze the wire is broken and the cap unscrewed and removed at the moment of loading.

Action.—After leaving the bore the rotation of the shell causes the weight of the tape to fly outwards, and the latter to become unwound from the steel collar; the halves of the steel collar in turn drop off, leaving the hammer supported only by the shearing wire.

The rotation of the shell causes the shutter to swing outwards until the hole formed in it comes into line with the central perforation in the detonator holder and magazine. On impact the hammer is driven in, breaking the shearing wire and piercing the detonator, the consequent detonation passes through the loose C.E. in the detonator holder, shutter and magazine to the C.E. pellet in the magazine, which in turn detonates the H.E. charge in the shell.

The *Mark IV S* fuze differs from the *Mark IV*, in the head of the hammer being made of steel instead of aluminium.

These fuzes are packed one in a tin cylinder, No. 101 F, with exploder.

FUZE, PERCUSSION, D.A., No. 106, MARK V.

(Plate XXX.)

This fuze is generally similar to the No. 106E described above, from which it differs principally in not having a removable magazine with safety shutter.

FUZE, PERCUSSION, No. 101E, MARK II.

(Plates XXXI.)

The fuze consists of the following principal parts:—

Body, cap with needle, graze pellet, plug, detonator, creep spring, centrifugal bolt, detent, detent spring, safety shutter and adapter.

The body is screw-threaded externally at its lower end to the 2-inch fuze hole gauge, while its upper end is conical in shape and fitted with a rounded cap. Below the cap the body is bored out to receive the graze pellet and below this again a fire channel leads to the safety shutter. A second opening, of two diameters, is bored in the body parallel to the fire channel for the reception of the detent and its spring; after assembly and inspection of the empty fuze this opening is closed at the top by a brass or copper ball. Near the upper end of the opening of the larger diameter and through that of the smaller diameter a hole is bored at right angles for the centrifugal bolt. Around the outside of the body is a knurled ring, black band or groove to denote that the fuze is not fitted with a cocked pellet, and

slots are provided to receive the "Key, No. 53" for fixing purposes. A groove is formed round the lower end of the body for the purpose of punch stabbing the fuze into the shell.

The lower end of the body is bored out and screwed to receive an adapter.

The cap, which is screwed into the upper end of the body, has a steel needle screwed in from the top.

The graze pellet is hollow and is screwed internally at its lower end for the plug. Its upper end is stepped to form seatings for the centrifugal bolt and creep spring. The space between the bottom of the pellet and the top of the shutter is filled by a paper cylinder.

The plug which is screwed into the graze pellet from the under side, has a central fire channel through it. It forms a support for the detonator.

The detonator consists of a copper cup containing 1.7-grains of detonating composition; the top of the composition is covered by a brass disc and copper washer and its underside by a brass disc, the whole being held in the cup by the top edge of the latter being spun over. It fits inside the graze pellet, in which it is held by the plug.

The creep spring is interposed between the upper end of the graze pellet and the underside of the cap.

The centrifugal bolt is fitted in an opening at the upper end of the body, the opening being closed by a screw plug. The bolt is kept in position by the stem of the detent which passes up behind it. Its inner end fits over a shoulder on the upper end of the graze pellet.

The detent consists of a body with pin connected by a ball and socket joint; the stem of the latter passes up through a hole in the top of the fuze and behind the centrifugal bolt and is kept in position by a spiral spring which bears against the underside of the body and is held in position by a plug screwed into the body of the fuze.

The safety shutter is housed in a circular recess on top of the gaine adapter. It comprises a metal disc, shutter, detent spring and tin cap.

The disc is circular and is bored axially to provide a fire channel, whilst a transverse slot is cut across its upper surface to receive the shutter, detent and spring. The shutter is rectangular in section and slides freely in the slot of disc, but normally masking the fire channel. One end is slotted and bored to receive the detent stem, the other end being plain. The detent of ball and stem in one, rests in the disc slot, with the stem entered in the shutter recess, centering the C.G. of shutter to the spring side of the fuze axis. The spiral spring retains the shutter in the closed position and lies between shutter and tin cap. The tin cap has a central fire channel and fits over the disc, retaining the shutter devices in the assembled position.

The shutter opens when spun at revolutions from 2,000 to 3,000 per minute.

The adapter is screwed externally at its upper end to screw into the bottom of the fuze, in which it is held by a set screw and internally for the greater part of its length to receive the gaine, which in turn is

held by a set screw. The upper end of the central opening is plain and enlarged to form a chamber for the reception of the safety shutter.

No preparation for action is needed.

Action.—On firing, the detent behind the centrifugal bolt sets back, compressing its spring. When the stem of the pin is clear of the fuze body, centrifugal force carries the stem over and the spring, reasserting itself, jams it under the shoulder of the recess. This leaves the centrifugal bolt free and the rotation of the shell causes the bolt to move outwards and so unlock the graze pellet. Whilst the shell is under acceleration in the bore, the comparatively slow rate of rotation and the friction caused by the set back of the shutter prevents the latter opening. After the shell has left the bore the shutter is moved outwards by centrifugal force, compressing the spring. In moving outwards it releases the detent, the detent stem being unsupported, moves out of centre and engages a shoulder in the shutter and so keeps the shutter clear of the fire-holes in cap and disc. During flight the graze pellet is prevented from moving forward by the creep spring, but on graze or impact it moves forward, carrying the detonator on to the needle. The flash from the detonator passes down through the fire channels to the gaine, which in turn detonates the bursting charge in the shell.

Packed one in a No. 101 F tin cylinder.

GAINE No. 2.

The gaine, which forms the magazine of the Nos. 101 E and 101 fuzes, is of steel, screw-threaded externally at each end to fit the adapter and take the closing cap, respectively. Internally it is bored from each end to form two compartments, separated by a diaphragm, which is pierced by a fire channel.

The upper and smaller compartment is filled with gunpowder, in the form of perforated pellets, on the top of which may be placed a solid layer of gunpowder to provide a delay action.

The larger compartment contains pressed C.E. and a 10-grain fulminate detonator. A charge of 4.5 grains of gunpowder is placed on top of the fulminate. The bottom cap closes the gaine.

When provided with delay, the gaine has a blue band and the fuze cap is painted blue.

Action.—The flash from the fuze detonator ignites the powder in the upper compartment and, so strengthened, passes through the fire channel to ignite the powder in the detonator. The fulminate detonates the C.E.

If fitted with delay powder the latter would burn through before passing on to the detonator, so introducing a pause between graze of shell and detonation of gaine.

FUZE, TIME AND PERCUSSION, No. 88.

(Plate XXXII.)

The Mark V fuze consists of the following principal parts: Body, percussion pellet with detonator, ferrule, creep spring, stirrup spring

and steel ball, time pellet with detonator, spiral spring, screwed needle, brass pins and washers, base plug, screwed plug, top and bottom composition rings and cap.

The *body*, which is of copper alloy, is screwed externally at the lower end to the 2-inch fuze-hole gauge and bored from the bottom to receive the percussion arrangement. It is further bored to form a magazine which is filled with fine grain powder and closed with a brass plug; an oblique hole leading upwards from this magazine to connect with the bottom composition ring is filled with fine grain powder. A vertical recess is drilled centrally in the stem of the body to take the time arrangement, with a radial fire channel leading to the top time ring. A double pointed steel needle is screwed into the diaphragm separating the recess for the time arrangement from the opening in the base to take the percussion arrangement. The stem of the body is fitted with two slots for pins to prevent the top composition ring from turning and is screwed to take a steel or copper alloy cap. The cap is threaded internally to fit the stem of the body; a slot is cut across the top to take the No. 48 key, or a screwdriver for clamping purposes when setting.

The flange of the body is engraved with graduations from 0 to 22 (in tenths) and with an arrow point in red to denote position of "safety." When the arrow and the line on the bottom ring coincide the fuze is set at "safety."

A slot in the flange of the body takes the "key, No. 17," or "key, No. 32," for fixing purposes.

The *percussion pellet*, which is of copper alloy, is held in position by the spiral spring, brass ferrule, brass stirrup spring, steel ball and a copper alloy screwed plug, contains a 1.7 grain composition detonator.

The *top and bottom composition rings*, which are of copper alloy, have a channel on their under side filled with composition, the top ring being filled with No. 83 fuze composition and the bottom ring with special composition, a hole is provided in each which allows the gas direct escape outside; this escape hole is lightly closed by means of a brass disc covered without by Pettman's cement, and waterproofed. Two semi-circular slots are cut on the inside of the top ring, which, in conjunction with the two slots in the stem and two pins, prevent the ring from turning.

A hole is bored in the top ring to convey the flash of the time detonator to the composition. A similar hole is bored in the bottom ring to convey the flash from the top ring. A cloth and vegetable paper washer is placed between the rings and between the bottom ring and the body. The bottom ring is fitted with a setting pin to take the "key No. 18," and is engraved with a line for setting purposes.

The exterior of the bottom time ring is lacquered red to indicate the special filling.

The *time pellet* is of copper alloy and contains a .75-grain detonator and a powder pellet, and is supported above the time needle by means of a spiral spring.

The *base plug* is of steel or copper alloy and is screwed externally to fit the bottom of the body. A hole is bored through the centre

and a recess is formed to take a brass washer and linen disc, the metal of the plug being burred over to hold them in position.

The *screwed plug* is screwed externally to suit the recess in the body. The interior is recessed to receive the flange of the percussion pellet. There is a central flash hole closed by a linen disc and metal washer.

The openings in the fuze are filled with waterproof composition.

To set the fuze.—Unclamp the cap and with the "key, No. 18," or by hand, revolve the bottom ring until the vertical line coincides with the required graduation on the body. Then clamp the cap and check the setting.

If the fuze is required to act on percussion only, it should be set at "safety" and clamped.

Action—time arrangement.—On discharge, the time pellet sets back on the time needle, overcoming the resistance of the spiral spring and firing the detonator. The flash passes through the fire channel in the stem to the composition in the top time ring, which burns until the communicating channel in the bottom time ring is reached, the composition of which burns in the opposite direction until the channel leading to the magazine in the fuze is reached, whence the flash passes through the base plug into the shell.

Percussion arrangement.—On shock of discharge the ferrule sets back, straightening the horns of the stirrup spring and releasing the steel ball, which, through centrifugal action, passes into a side channel prepared for it in the body of the fuze. The pellet, being now held only by the creep spring, is free, on impact, to move forward on to the detonator, the flash of which passes through the hole in the pellet and base plug into the shell.

Mean time of burning at rest, set full, 48 seconds. Weight, 1-lb. 10½-ozs.

The fuze is packed one in a tin cylinder, No. 87 F, Mark III.

FUZE, TIME, NO. 188 M, MARK V.

(Plate XXXIII.)

This fuze differs from the No. 88, Mark V, described above, in having the percussion arrangements removed and replaced by a wood plug driven in; a perforated powder pellet is inserted in the magazine in place of a charge of powder, the pellet being retained in position by a paper disc placed over the pellet and secured to the base plug with shellac. These fuzes are distinguished by having a blue "T" stencilled on the cap and rings.

ADAPTER, 2-IN. FUZE-HOLE, NO. 12.

This adapter is made of steel or metal and is for use with time fuzes and No. 2 gaine in H.E. shell.

It is screwed on the exterior to the 2-inch fuze-hole gauge for a certain distance, below which it is turned plain. A hole is bored out from the bottom and screwed to receive a No. 2 gaine and a groove is cut across the top to accommodate a safety shutter, which is retained

in position by a perforated tinned plate cap soldered to the top of the adapter.

TUBES.

TUBE, PERCUSSION, S.A. CARTRIDGE, MARK I.

(Plate XXXIV.)

The form and general dimensions are shown on Plate XXXIV. It consists of a body with cap and cork disc.

The body and cap consist of the .303-rifle cartridge-case filled with a charge of 30-grains, S.M.¹ or R.F.G.² powder. It is closed at its front end with a cork disc, which is covered with shellac varnish before insertion, and the exposed side afterwards waterproofed with shellac.

Packed 20 in a "Box, Tube, Percussion, S.A. Cartridge."

TUBE, PERCUSSION, S.A. CARTRIDGE, DRILL, MARK I.

The drill tube consists of a .303-inch cartridge case with the anvil removed from the cap chamber and the body filled with a wood plug secured by the neck of the case being indented into it in three places. Three elongated indents equally spaced are formed in the case and filled with red paint to distinguish it from the service tube.

NOTE.—In the event of a tube failing to ignite the charge, care should be taken when extracting the tube not to stand directly in rear of the gun, as the tube may fly out with some violence as soon as the lock is clear.

By Command of the Army Council,

H. J. Creed

THE WAR OFFICE,
December, 1921.

MILITARY BOOKS, published by Authority—continued.

(As to prices in brackets, see top of page 2.)

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(As to prices in brackets, see top of page 2.)

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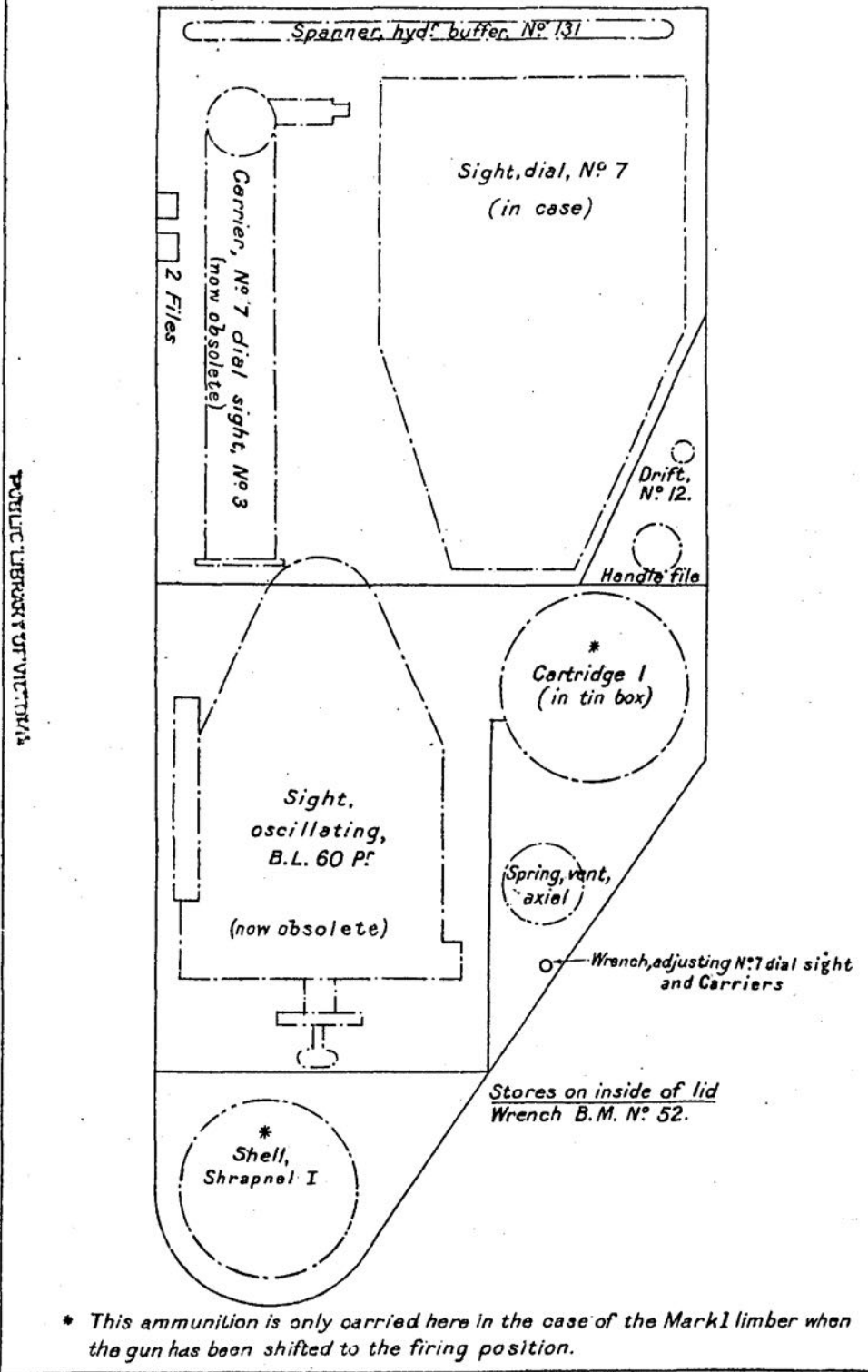
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BOX, LIMBER, B.L. 60-PR CARRIAGE."NEAR"



BOX, LIMBER, B.L. 60-P^r CARRIAGE. "OFF."

Trey small stores,
on top, containing:-

Bolts, stop, yoke band 2

Lanyard, firing, N° 33.

Ordnance B.L. 60. Pr:-

+ Springs -
catch (B.M. Lever /
ret^a breech screw)

+ Pins, keep split

$\frac{3}{16}$ " x 4" 1

$\frac{3}{16}$ " x $1\frac{3}{4}$ " 1

$\frac{1}{8}$ " x $1\frac{1}{4}$ " 1

+ Plugs, air holes-

$\frac{3}{8}$ inch 1

$\frac{1}{4}$ 1

+ Plug, filling hole, hydr
buffer N° 39. 1

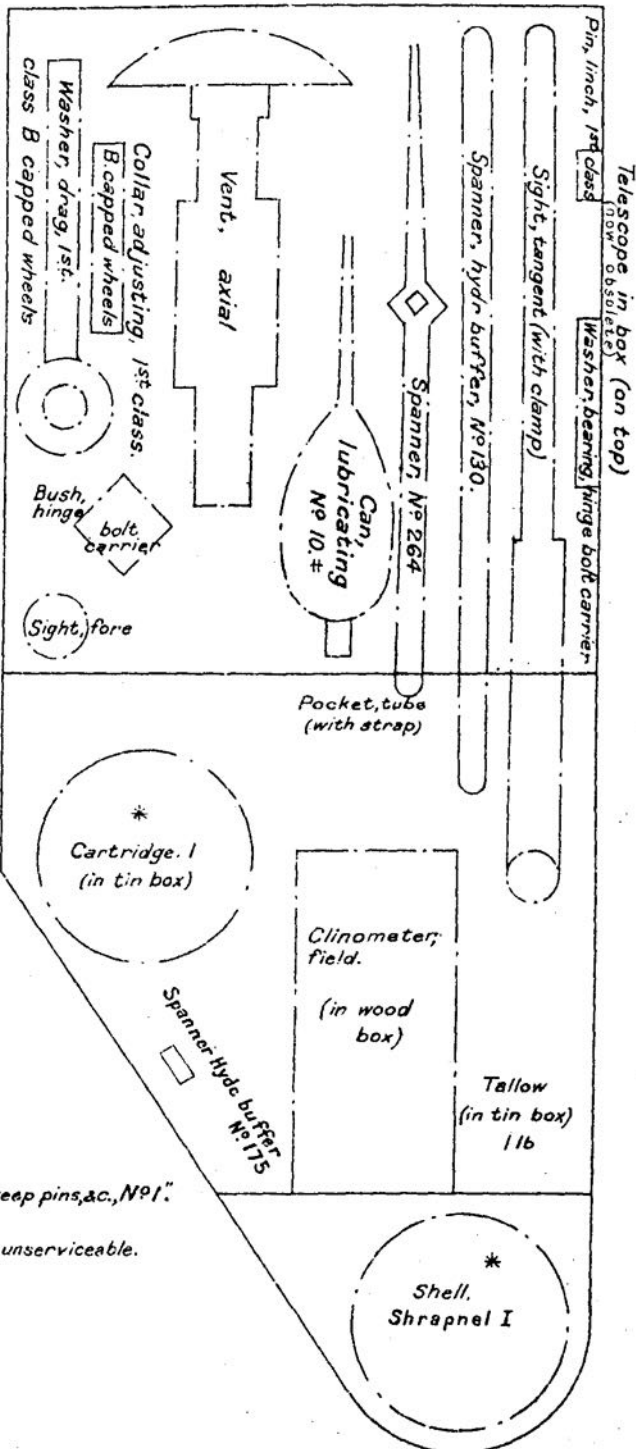
+ Spanner, hydr buffer N° 132. 1

+ Screws, lubricating hole
 $\frac{5}{16}$ x $\frac{3}{8}$ 2

+ In tin "Box, spare springs, keep pins, &c., N° 1."

± Will not be replaced when unserviceable.

* This ammunition is only carried here in the case of the Mark I limber when the gun has been shifted to the firing position.

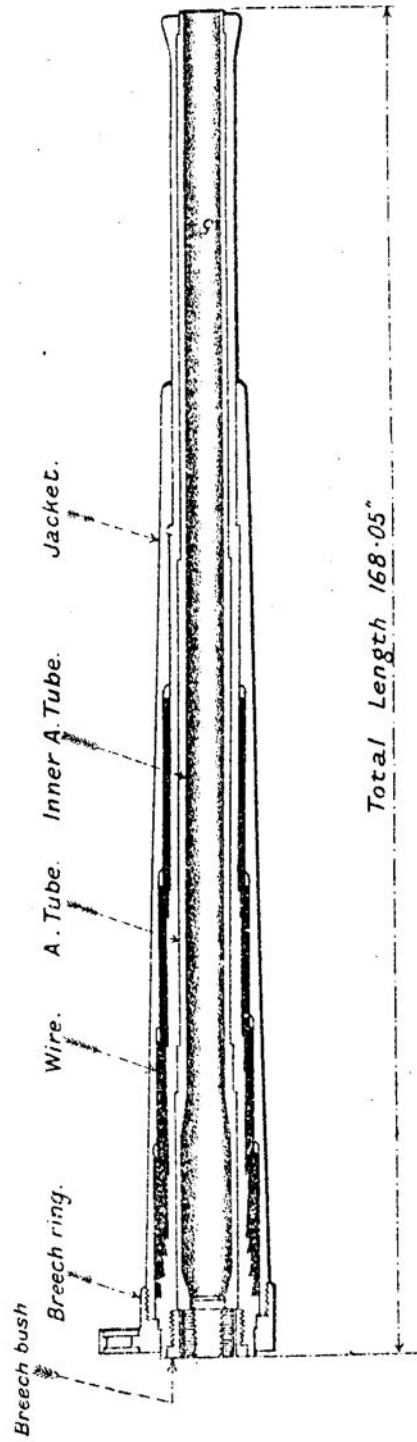


PUBLIC LIBRARY OF VICTORIA

ORDNANCE, B. L. 60-PR, MARK I.

SCALE = $\frac{1}{24}$.

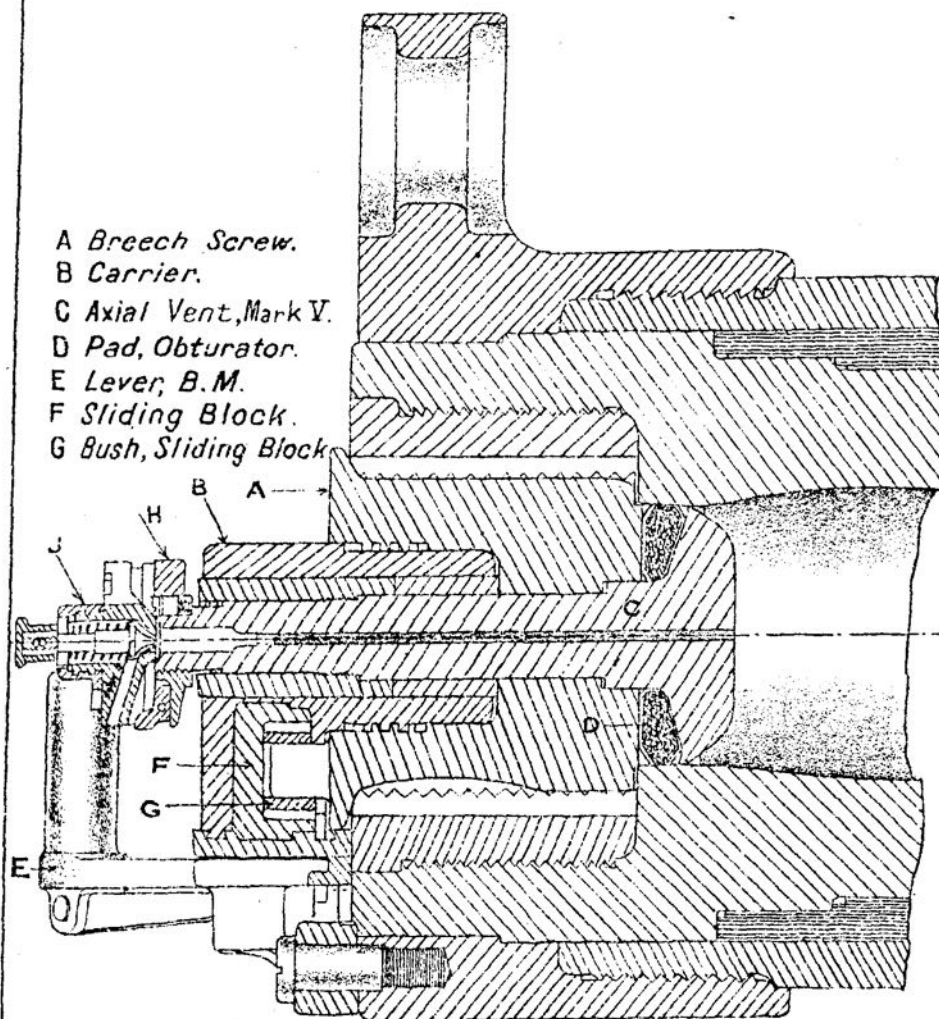
(TYPICAL FOR MARKS I* & I**)



P.T.O.

ORDNANCE, B.L. 60-PR "A" AND "B".

ARRANGEMENT OF FIRING MECHANISM.
WITH BOX, SLIDE, "V" & LOCK, PERCUSSION, "P.H."

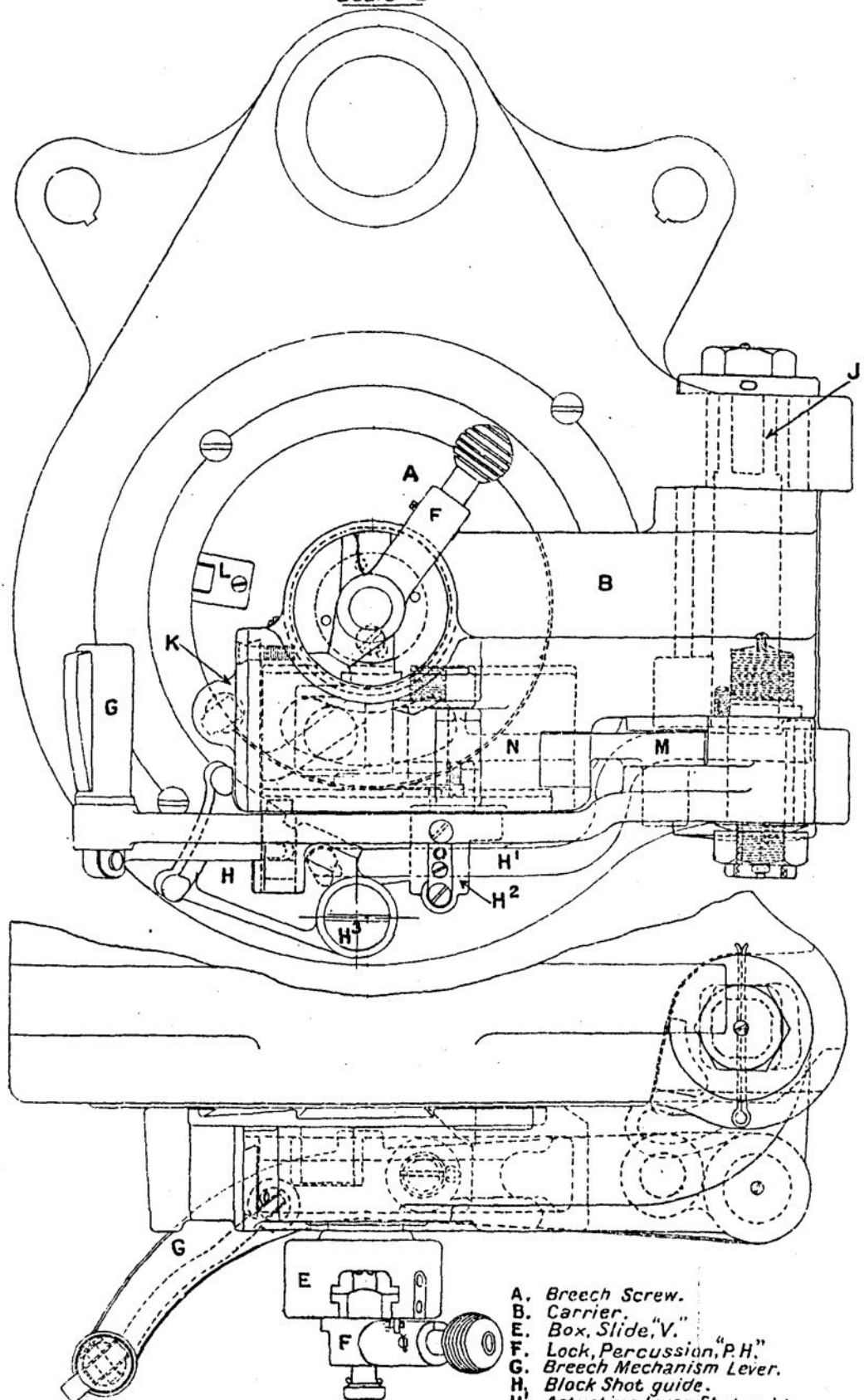


- A Breech Screw.
- B Carrier.
- C Axial Vent, Mark V.
- D Pad, Obturator.
- E Lever, B.M.
- F Sliding Block.
- G Bush, Sliding Block.

- H Box, slide, "V."
- J Lock, percussion, "P.H."

Plate III.

ORDNANCE, B.L. 60-PR., "A" AND "B" MARKS I TO I.**
General Arrangement of Firing Mechanism with Box, Slide, "V" & Lock, Percussion, "P.H."
 Scale 1/2

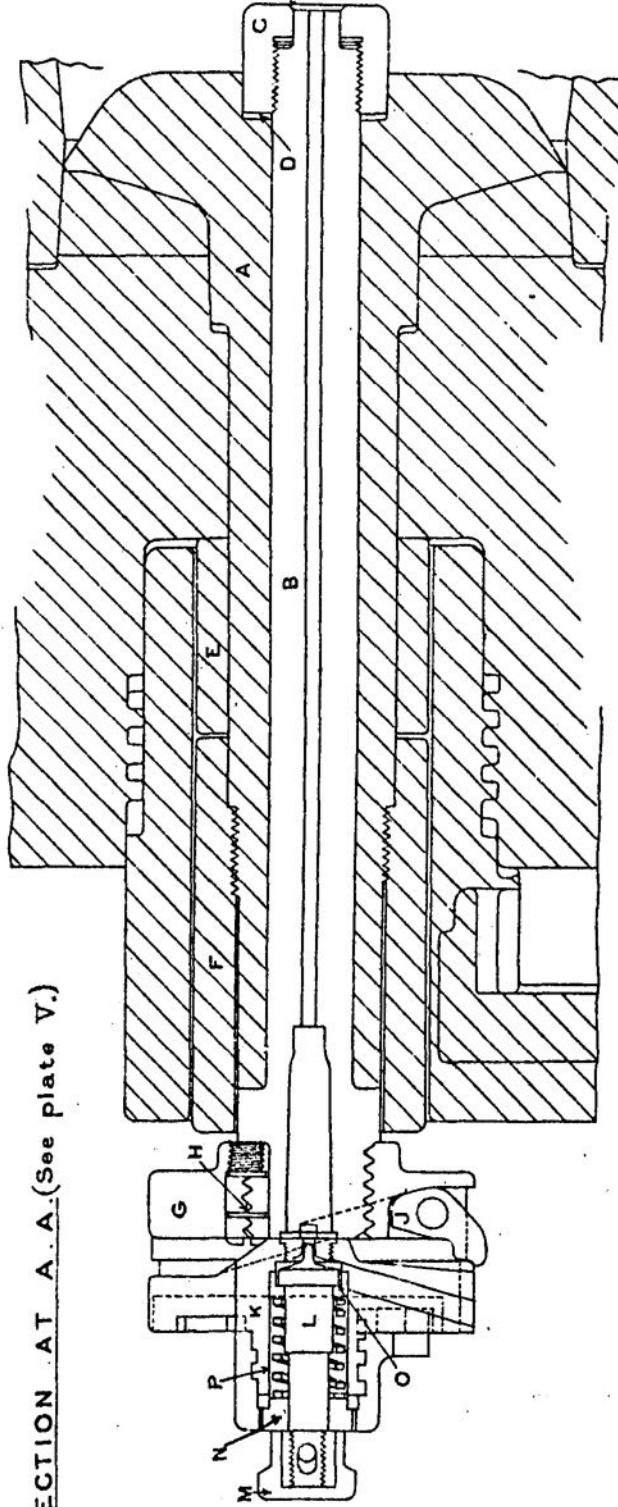


- A. Breech Screw.
- B. Carrier.
- E. Box, Slide, "V."
- F. Lock, Percussion, "P.H."
- G. Breech Mechanism Lever.
- H. Block Shot guide.
- H¹. Actuating lever Shot guide.
- H². Bracket Shot guide.
- H³. Hinge Screw Shot guide.
- J. Carrier hinge bolt.
- K. Catch retaining breech screw.
- L. Plate, catch retaining breech screw.
- M. Link Actuating breech Screw.
- N. Sliding block.

ORDNANCE, B. L., 60-PR. "A" AND "B", MARKS I TO I**.
GENERAL ARRANGEMENT OF FIRING MECHANISM WITH "LOCK, PERCUSSION, PH." AND "BOX, SLIDE 'V'".

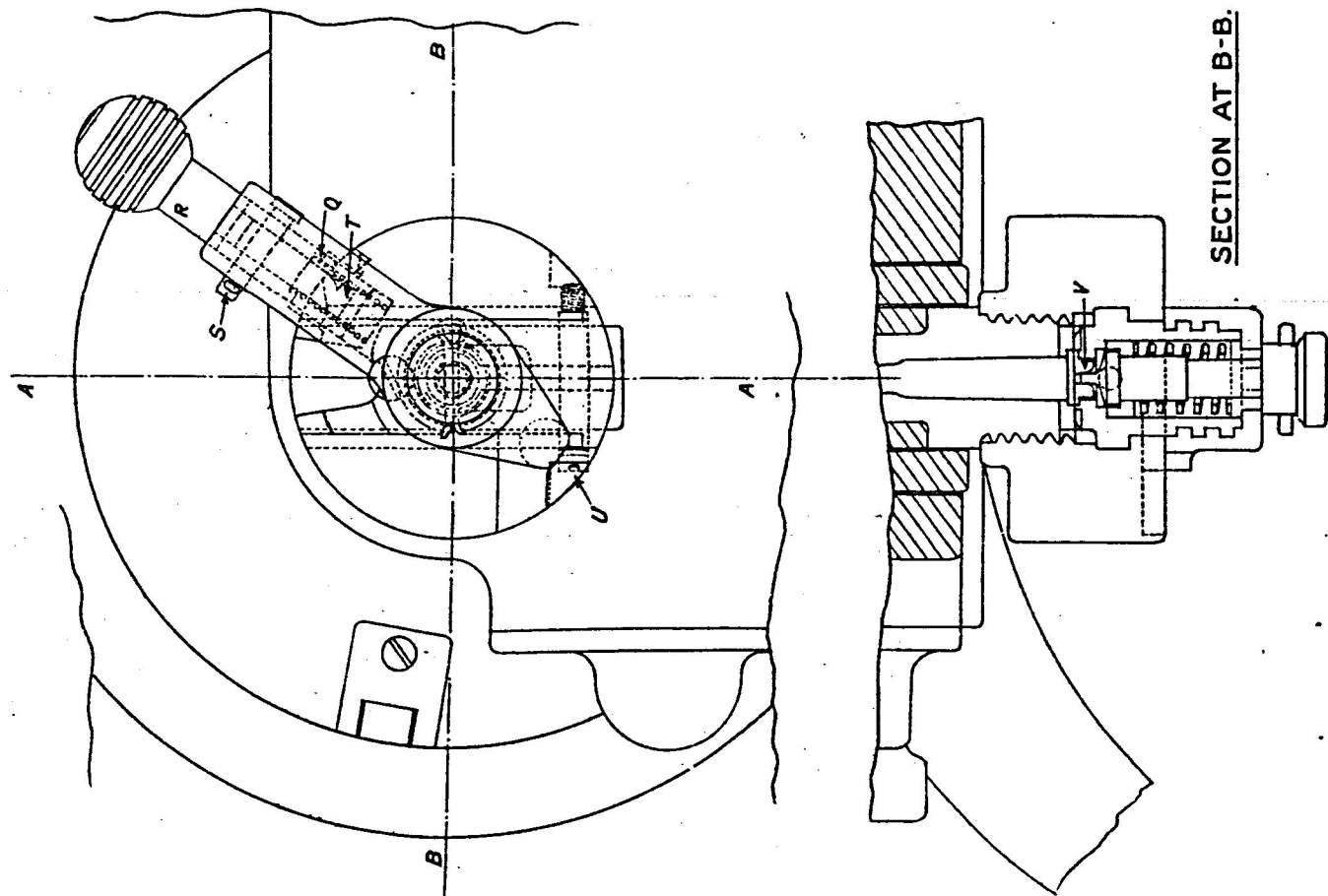
SCALE 1/2.

SECTION AT A. A. (See plate V.)



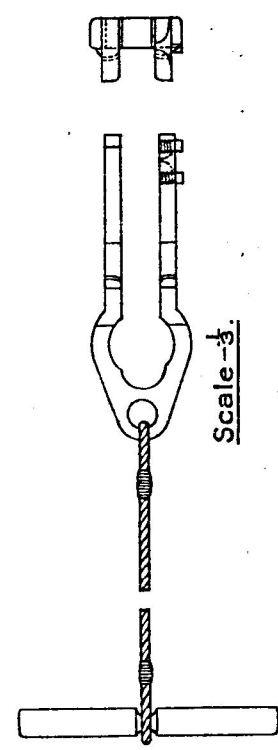
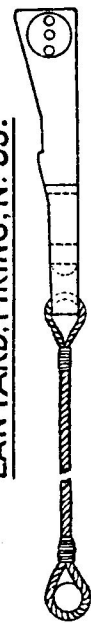
- | | | |
|--|-----------------------------------|------------------------|
| A. Vent axial Mark IV - Typical for Mk's III*, IV** & II***** axial vents. | F. Nut, Mark IV axial vent. | L. Striker spindle. |
| B. Vent bush spindle. | G. Box, slide "V" | M. Striker cap. |
| C. Nut, vent bush spindle. | H. Securing screw, box, slide "V" | N. Rebound collar. |
| D. Washer, vent bush spindle. | J. Extractor lever. | O. Main spring collar. |
| E. Sleeve, Mark IV axial vent. | K. Lock, percussion "PH." | P. Main spring. |

General Arrangement of firing mechanism with "Lock, Percussion, P.H." "Box, slide 'V'"
 Scale - $\frac{1}{2}$.



- Q — Lock actuating lever.
- R — Retaining catch plunger.
- S — " " guide pin.
- T — " " spring.
- U — Extractor axis screw.
- V — Firing hole bush.

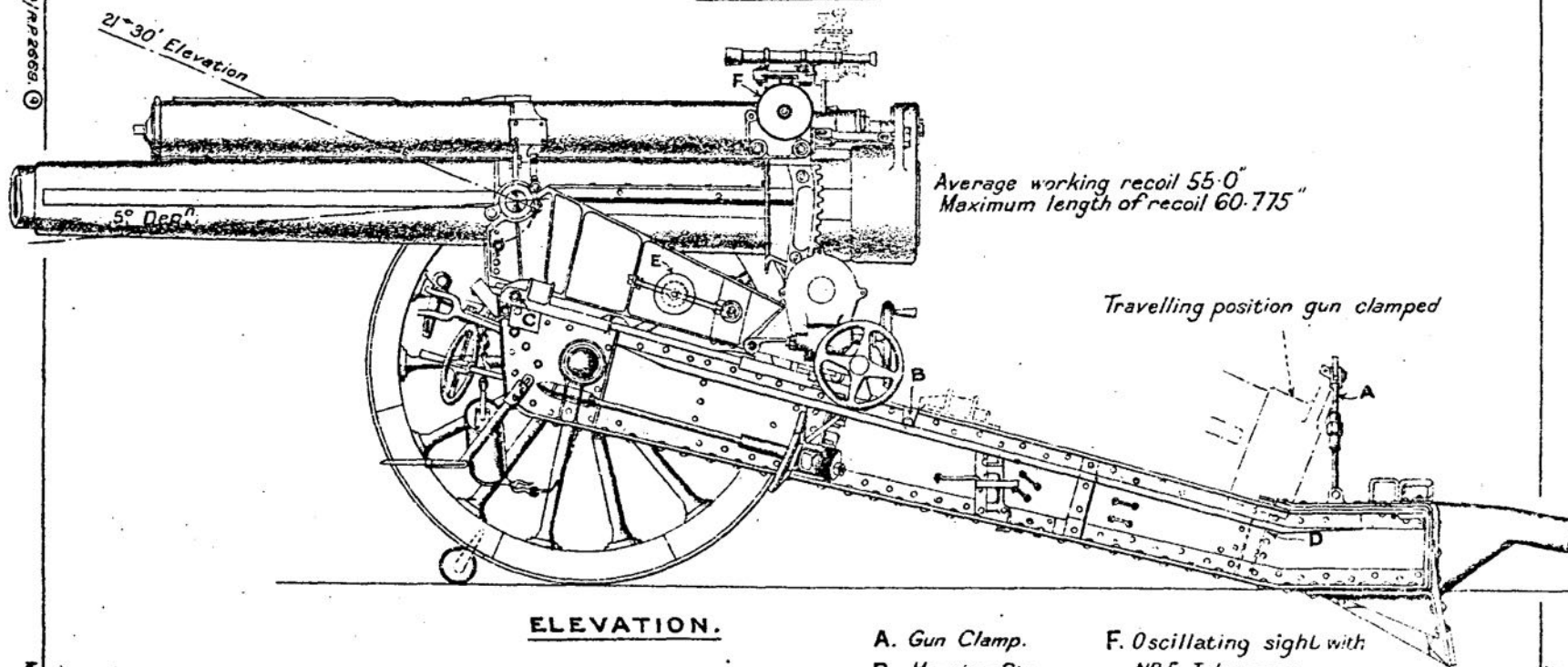
LANYARD, FIRING, N° 33.



Scale - $\frac{1}{3}$.

CARRIAGE, FIELD, B.L. 60-P^R, MARK I.

SCALE = 1/24.



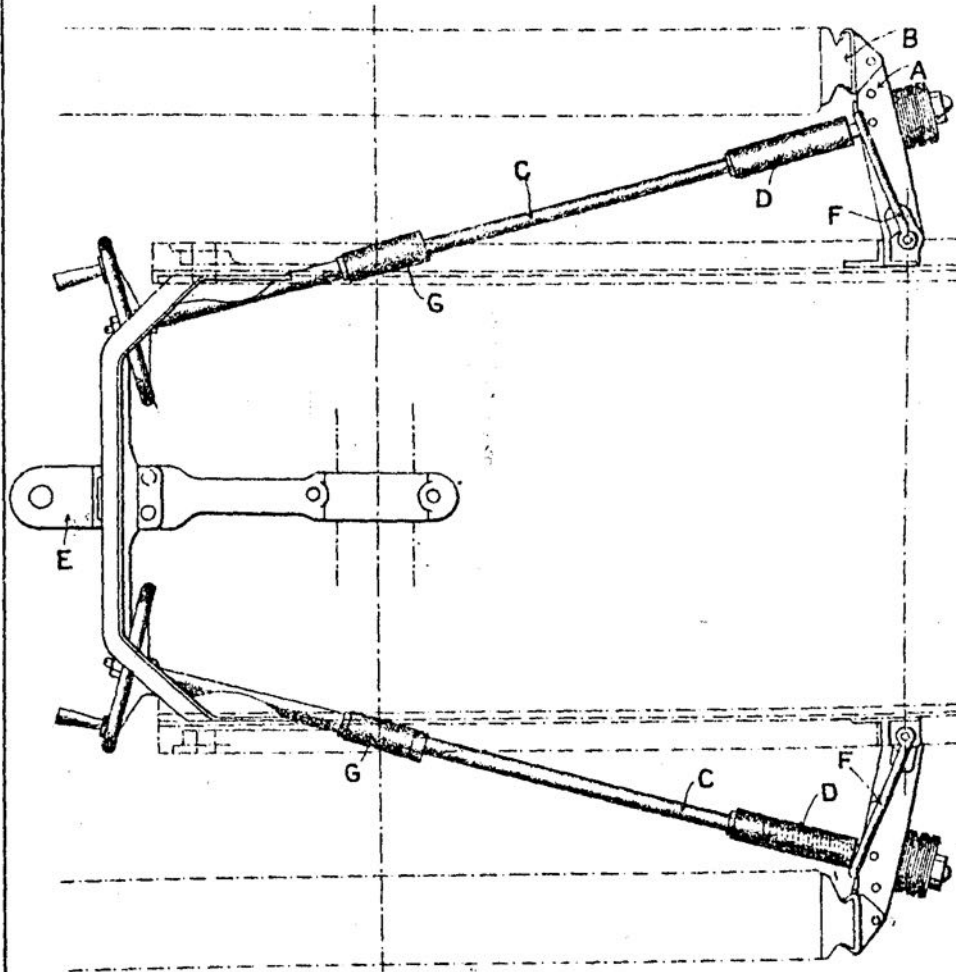
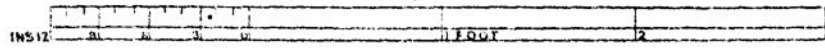
ELEVATION.

NOTE. The Oscillating Sight with N^o 3 Carrier will be replaced by the N^o 6. Carrier (See Plates XX & XXI.

- | | |
|------------------|---|
| A. Gun Clamp. | F. Oscillating sight with N ^o 5 Telescope. |
| B. Housing Stop. | |
| C. Locking Bolt. | |
| D. Gun Rest. | |
| E. Bollard. | |

CARRIAGE, FIELD, B.L. 60-P.R., MARK I. ARRANGEMENT OF BRAKE GEAR & DRAUGHT LINK.

Scale



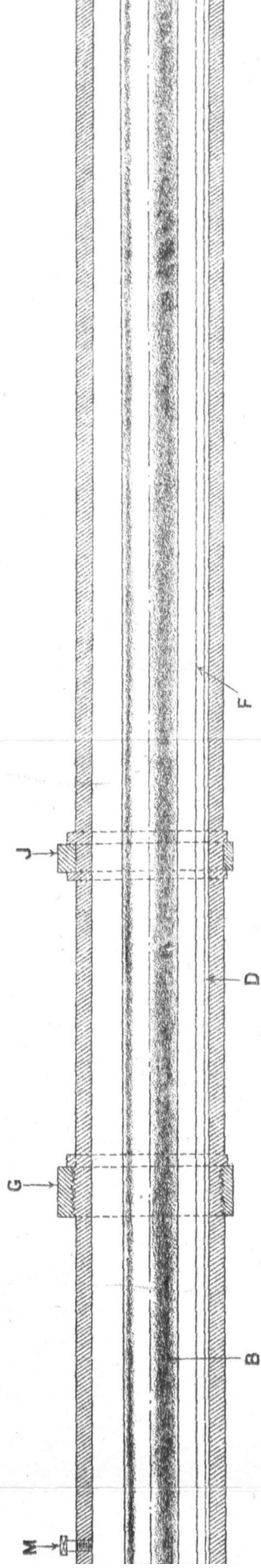
- A. Brake arm.
- B. Brake block.
- C. Actuating rod.
- D. Actuating nut.
- E. Draught link.
- F. Supporting stay.
- G. Bearing on axle tree bracket.

CARRIAGE, FIELD, B.L. 60-PR, MARK I.

ARRANGEMENT OF HYDRAULIC BUFFER, MARK I.

SCALE $\frac{1}{4}$.

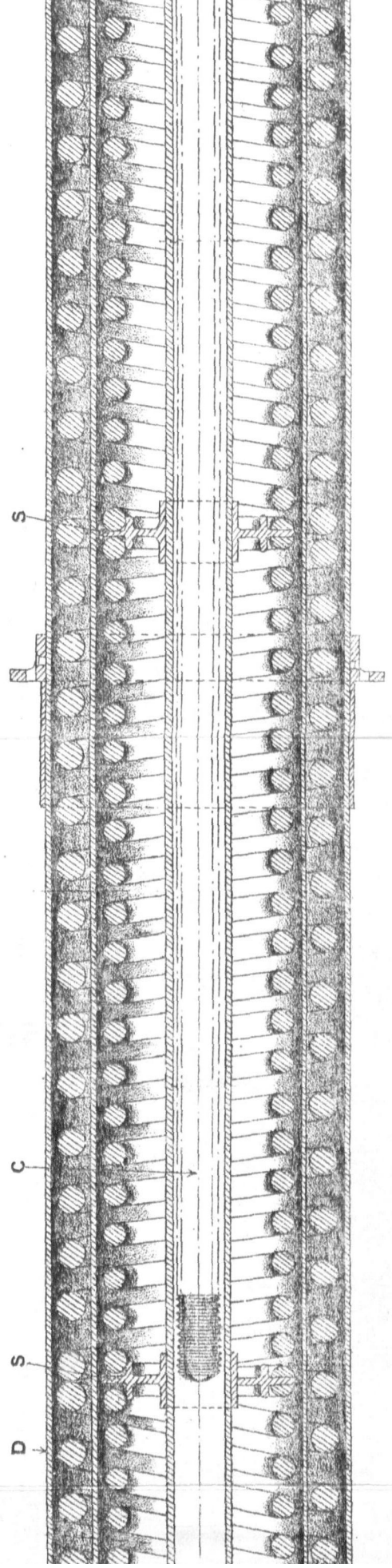
Recoil { Maximum 60.75 inches
Average Working 55 inches



CARRIAGE, FIELD, B.L., 60-PR, MARK I.

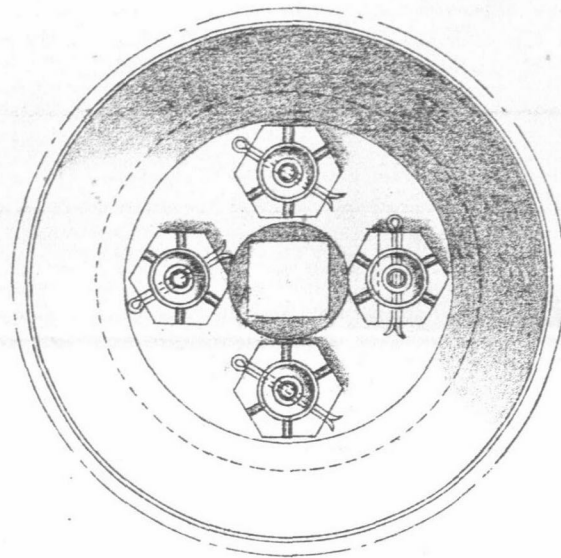
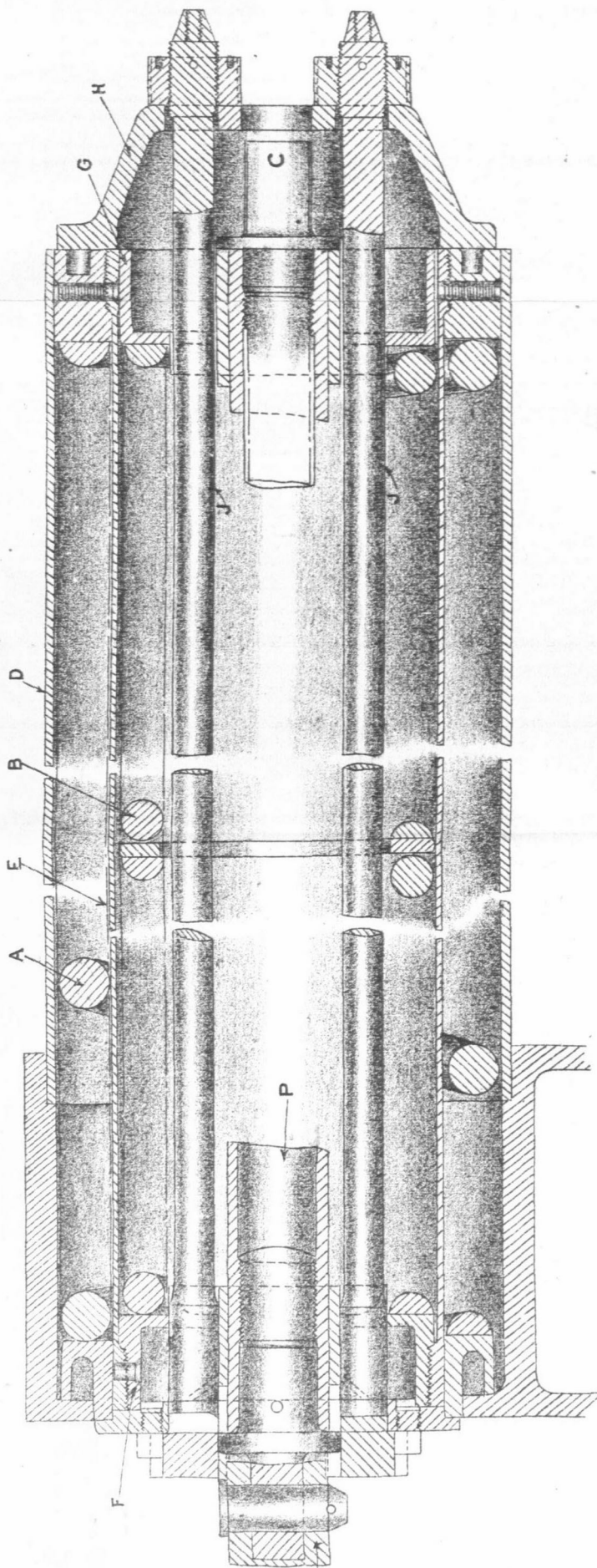
GENERAL ARRANGEMENT OF RUNNING OUT SPRINGS, MARK I.

SCALE = $\frac{1}{4}$.



CARRIAGE, FIELD, B. L. 60 - P_R, MARKS I AND III.

GENERAL ARRANGEMENT OF PRESS RUNNING OUT, MARK I AND II.

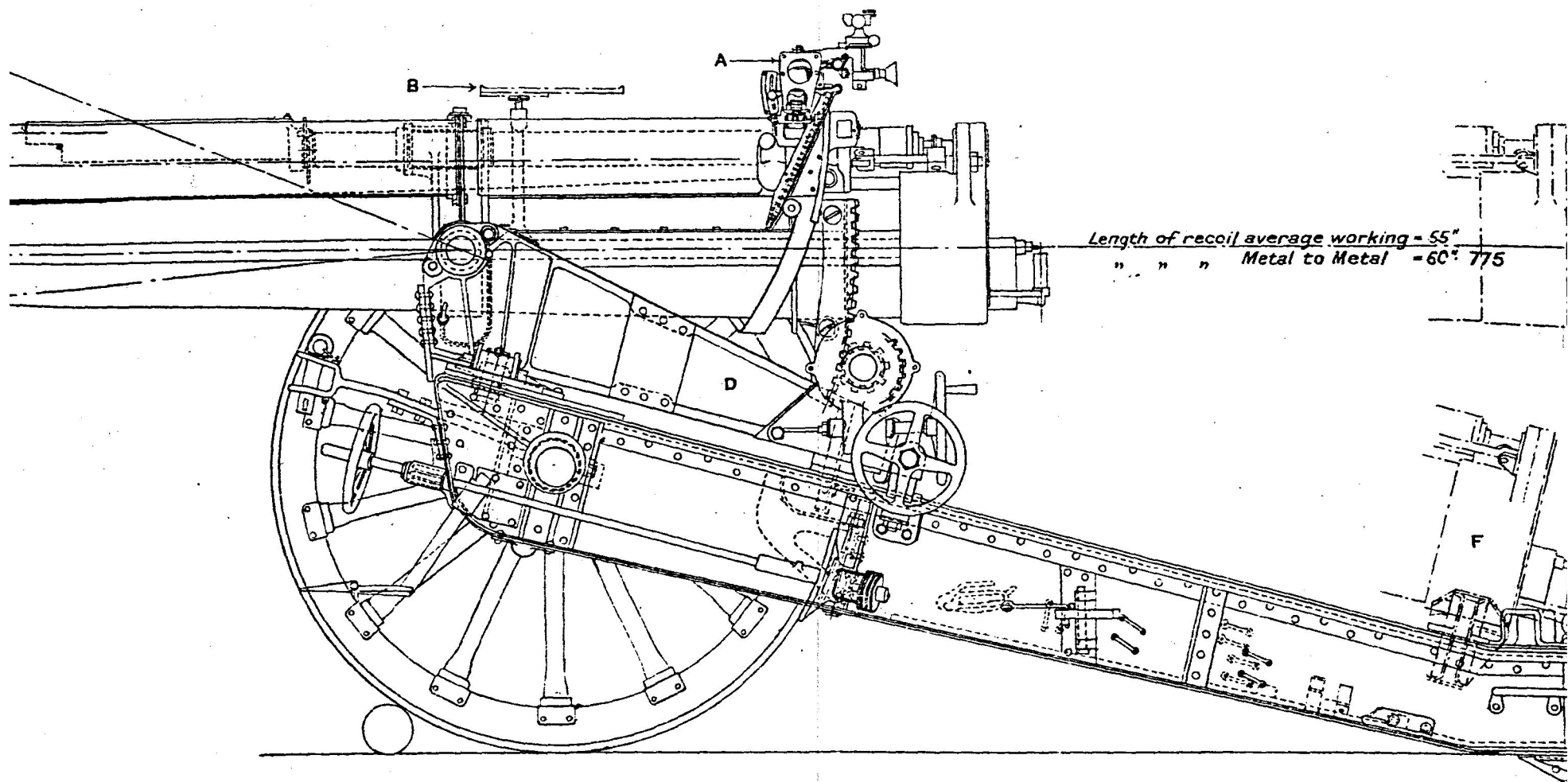


FRONT END VIEW

ter springs.
 ner "
 new compressing springs.
 ter spring case.
 ner spring case.
 " " " bearing, rear.
 late " " " front.
 ap " "
 nsion bolts
 connecting lug running out rod.
 unning out rod.

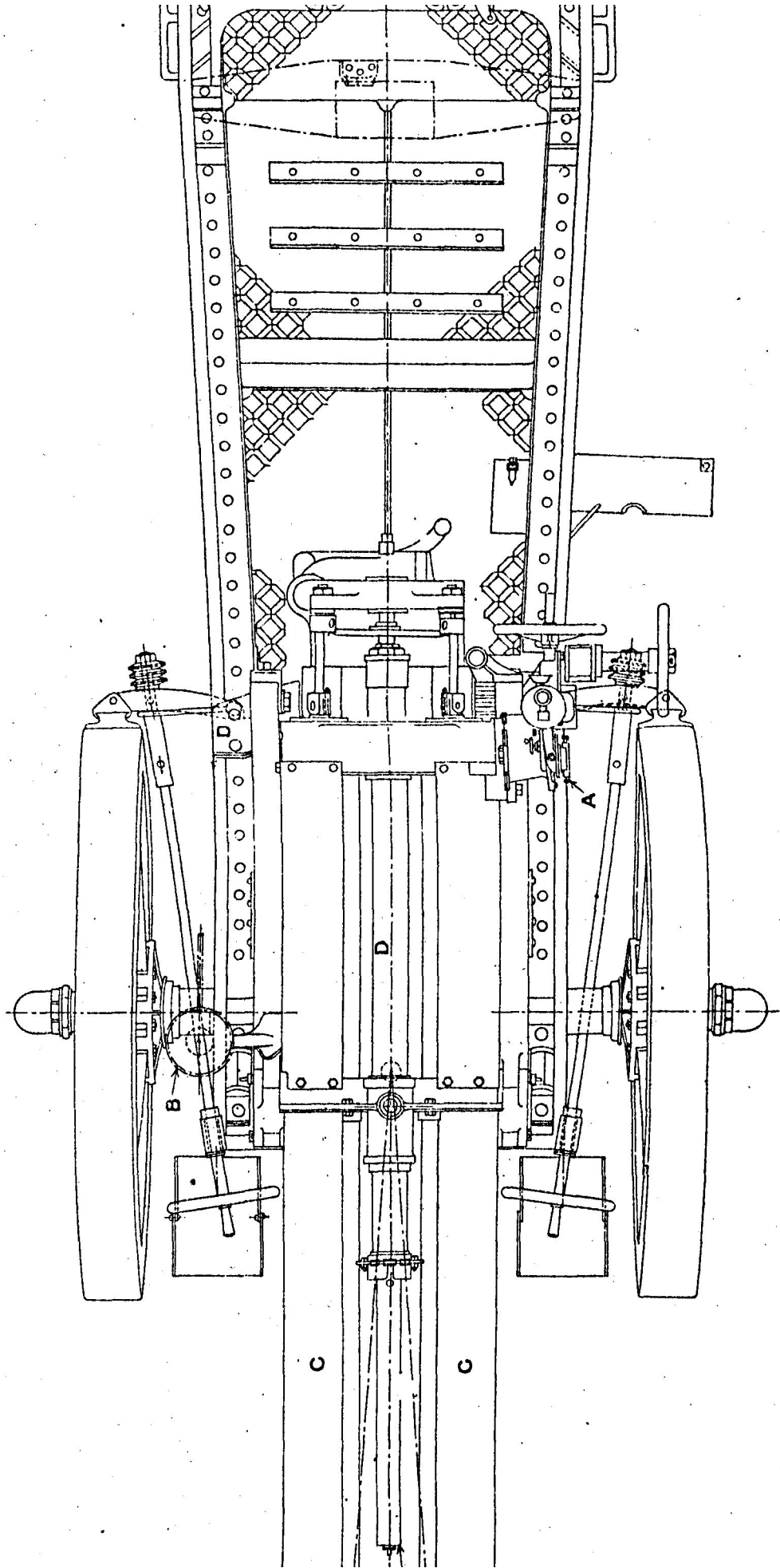
CARRIAGE, FIELD, B. L. 60-PR, MARK III.

Scale = $\frac{1}{16}$



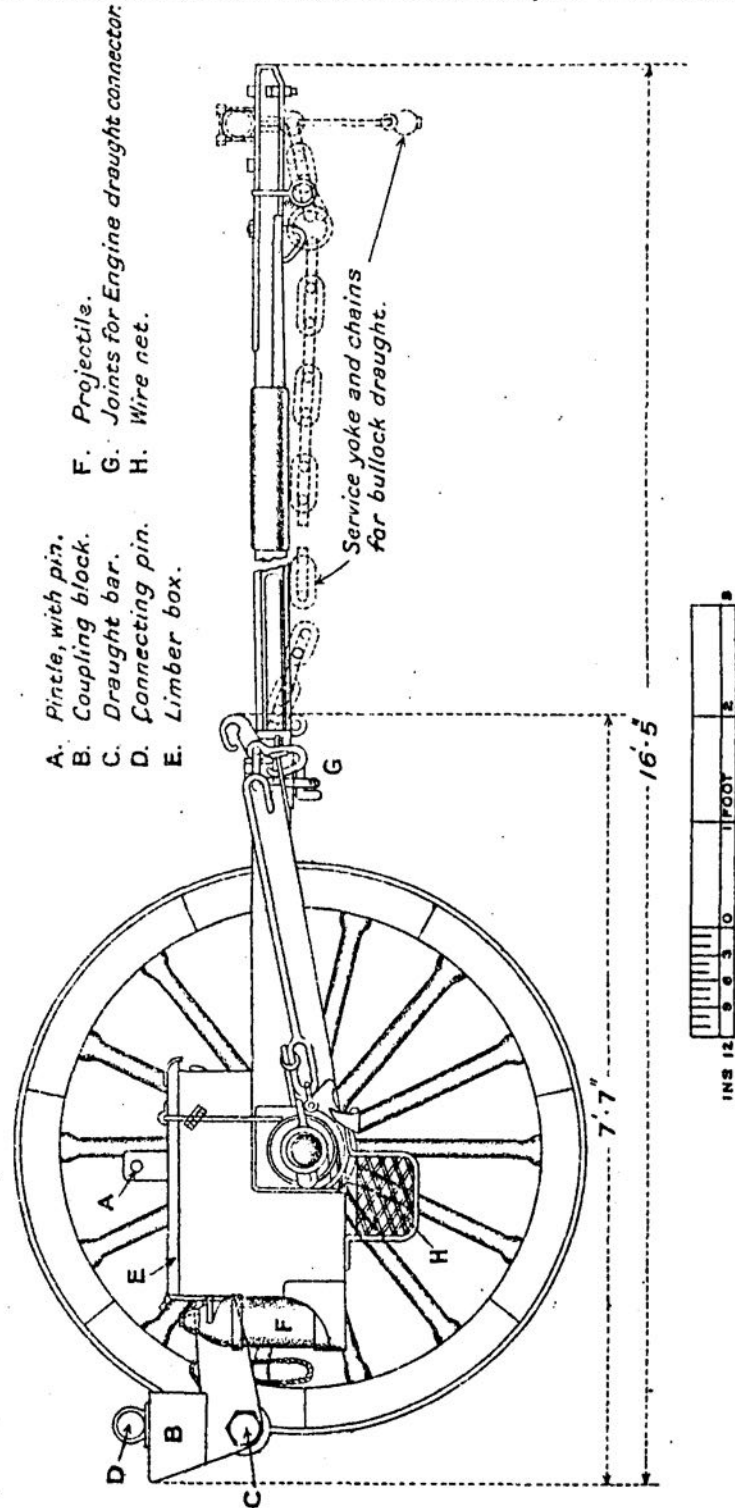
CARRIAGE, FIELD, B. L. 60-PR., MARK III.

SCALE-16

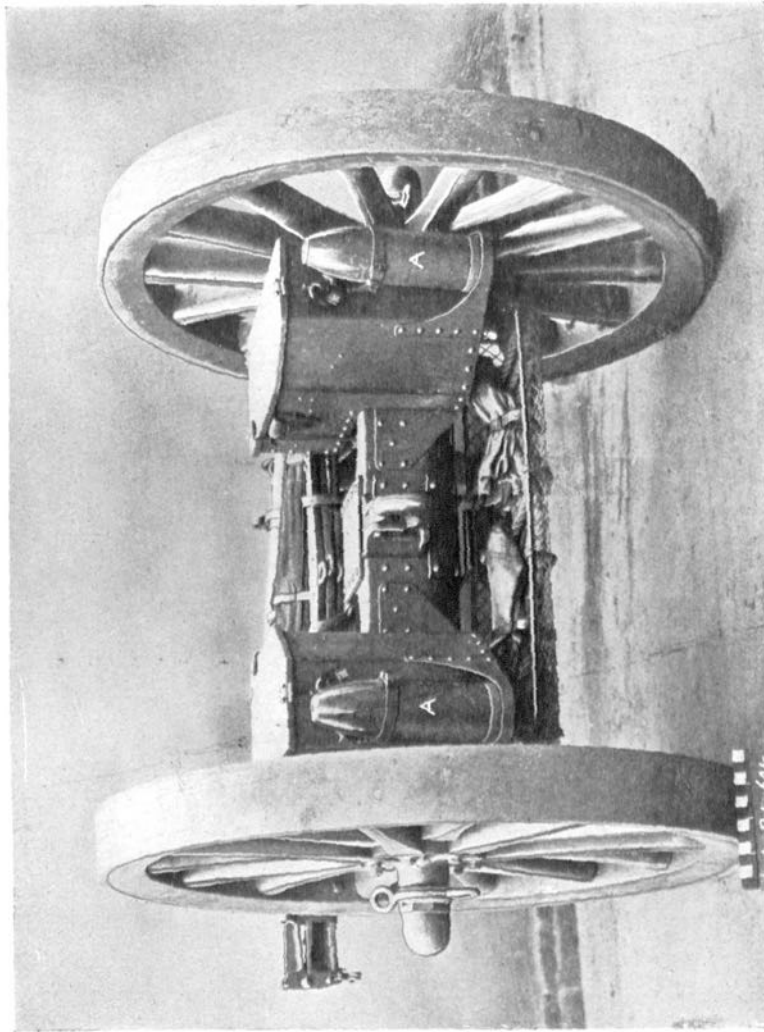


LIMBER, B.L., 60-PR., CARRIAGE, MARK I.

SIDE ELEVATION.

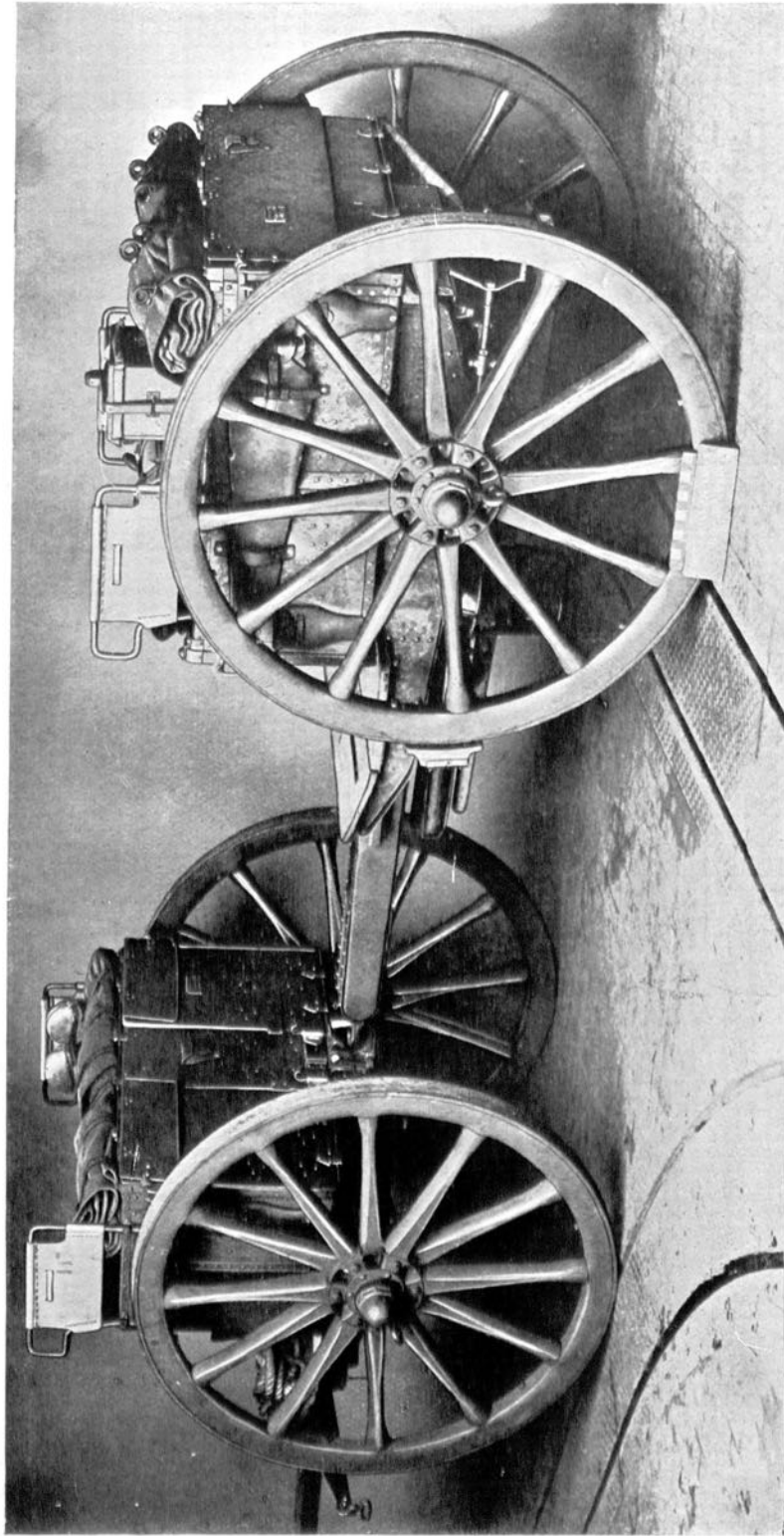


PUBLIC LIBRARY OF THE CITY OF VICTORIA
LIMBER B.L. 60-PR. CARRIAGE, MARK II*.

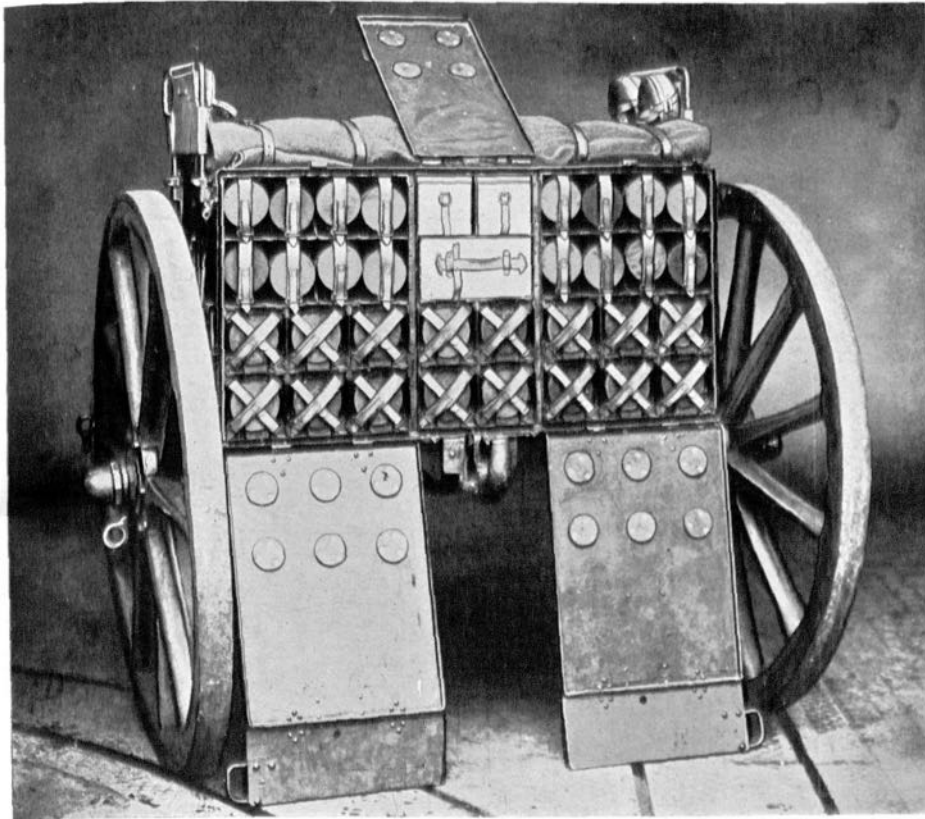


NOTE.—The two shells marked "A" are not now carried as shown.

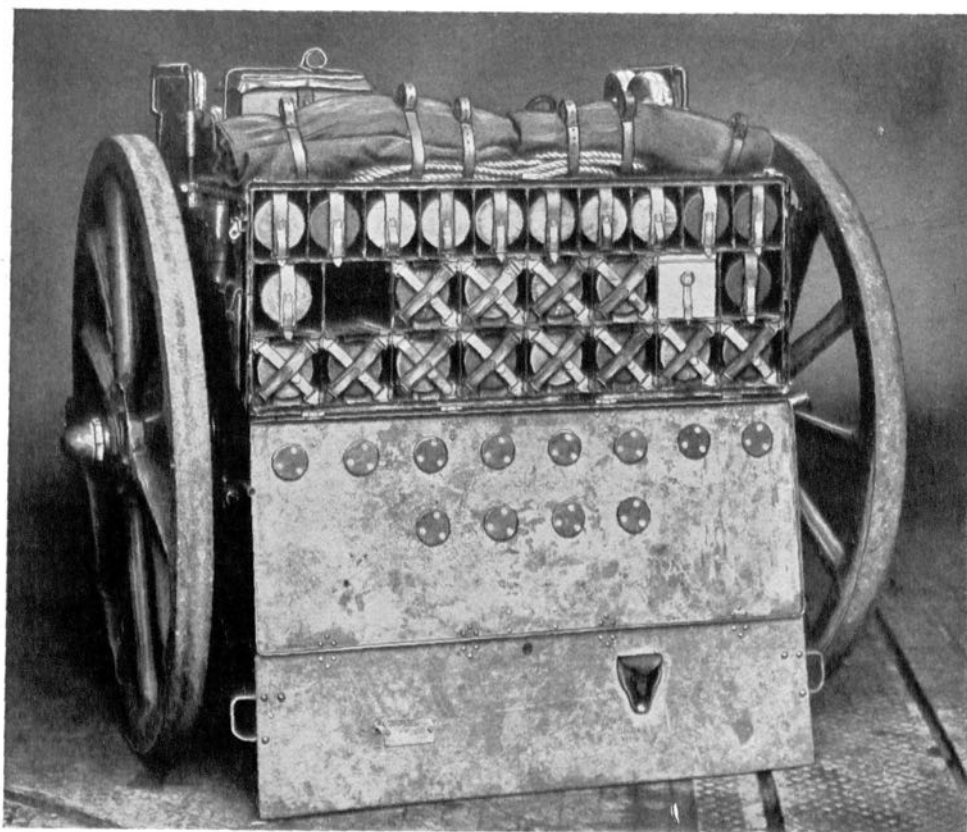
LIMBER, AND WAGON, AMMUNITION, B.L., 60-PR., MARK II.



LIMBER, B.L., 60-PR. WAGON, MARK II.

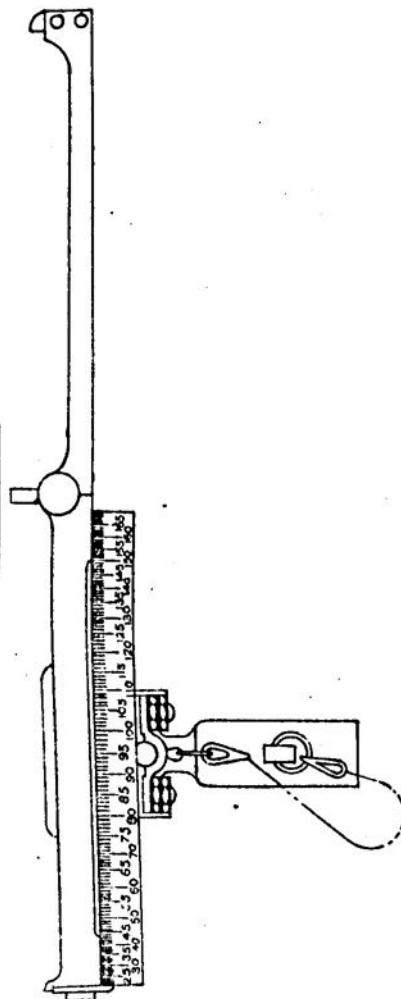


WAGON, AMMUNITION, B.L., 60-PR., MARK II.

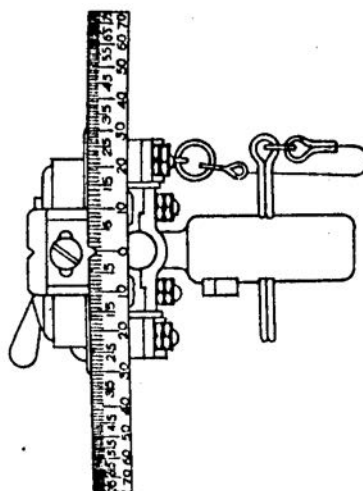


SIGHT, DIAL, No 1. MARK II.

Scale = $\frac{1}{3}$



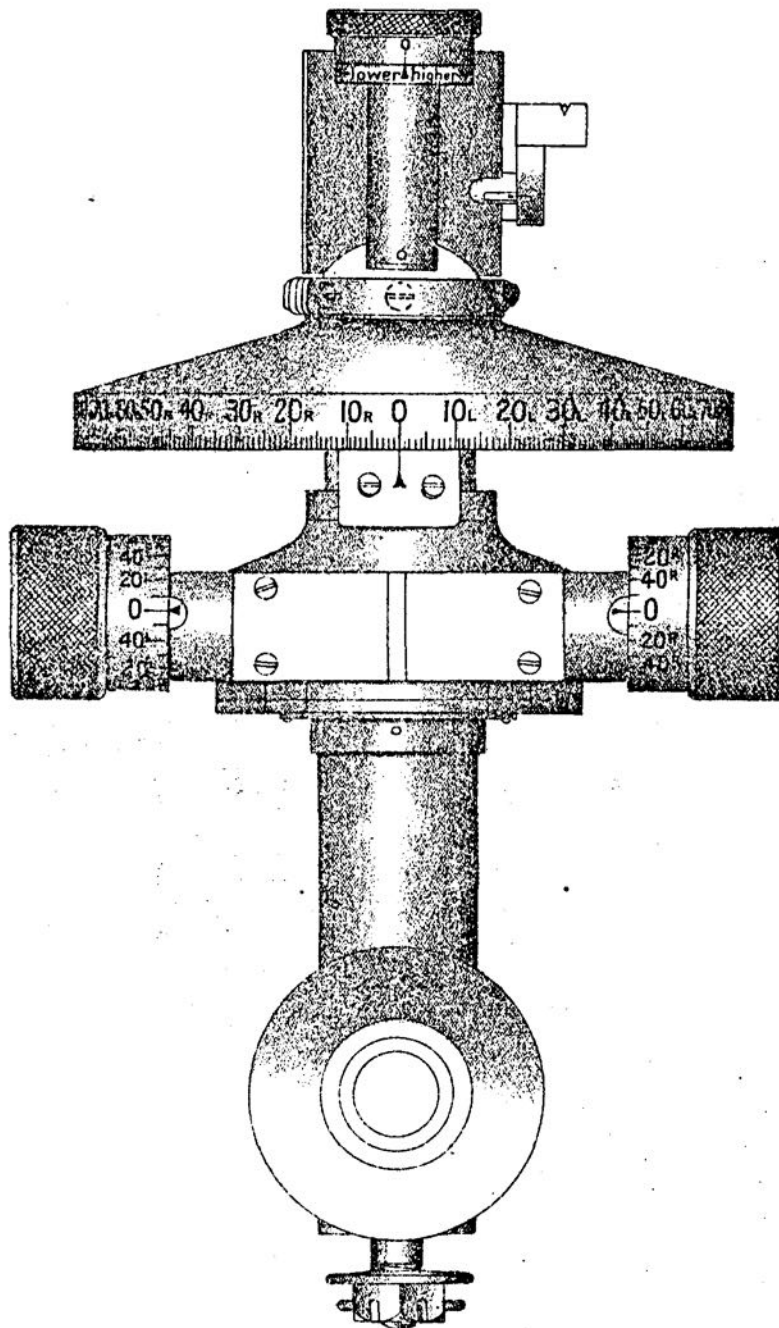
SIDE ELEVATION.



REAR ELEVATION.

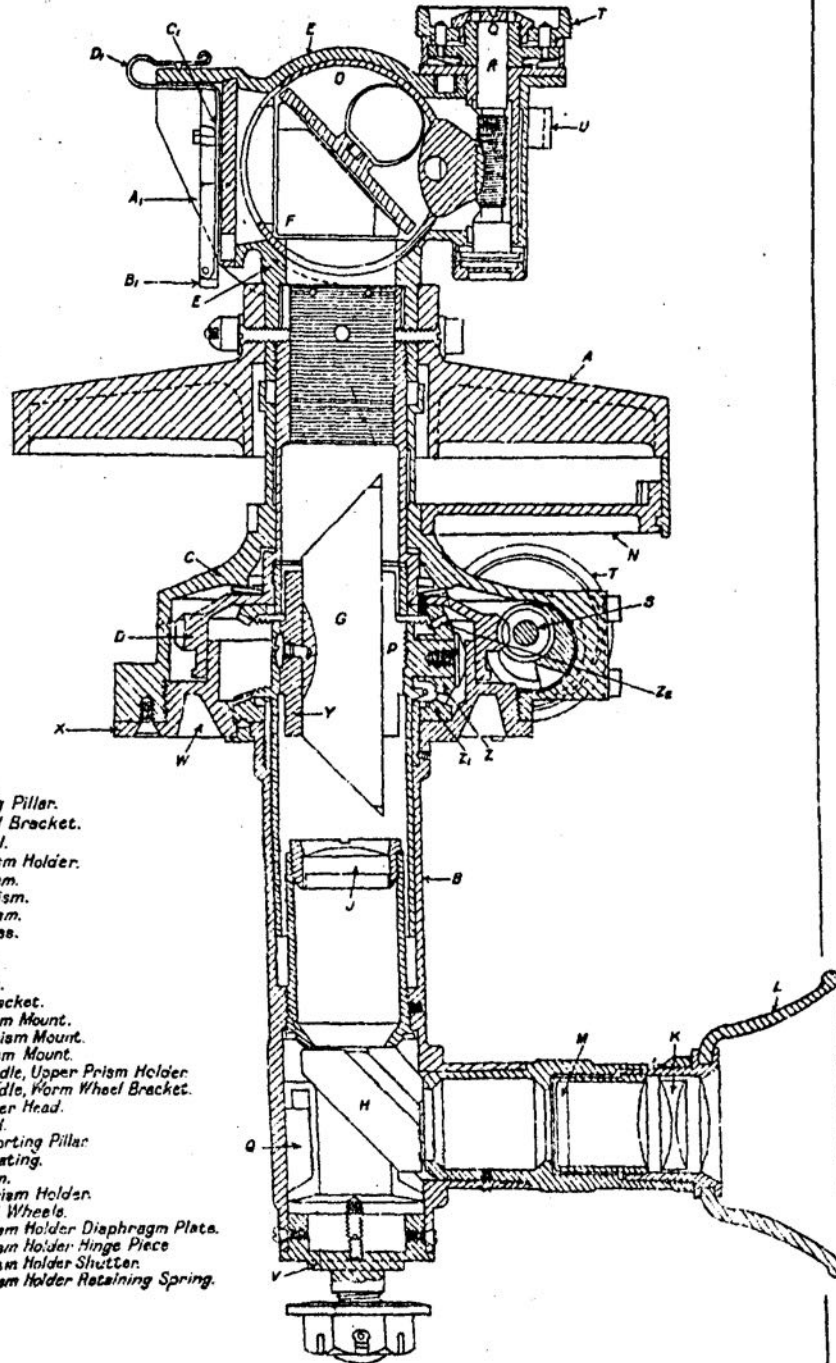
SIGHT, DIAL, N°7, MARK III.

SCALE $\frac{2}{3}$



SIGHT, DIAL, NO 7, MARK III.

Scale $\frac{2}{3}$

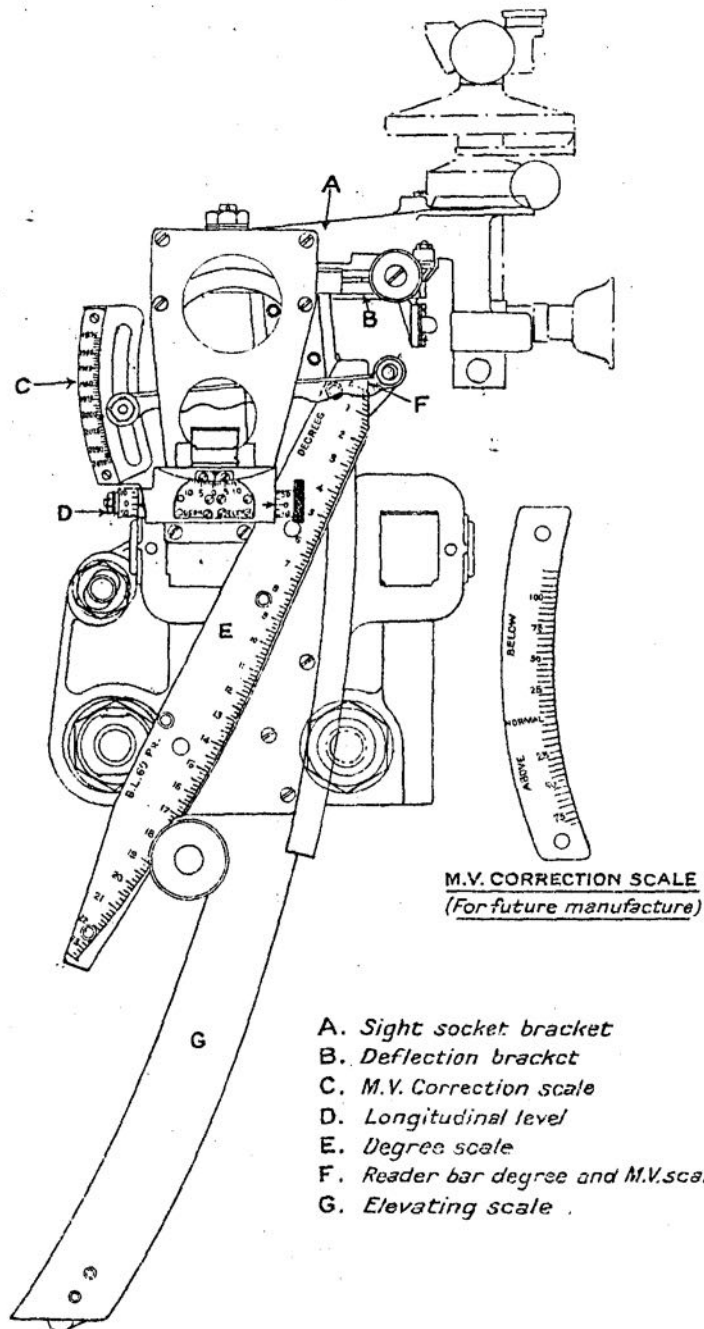


- A. Dial Plate.
- B. Supporting Pillar.
- C. Wormwheel Bracket.
- D. Wormwheel.
- E. Upper Prism Holder.
- F. Upper Prism.
- G. Centre Prism.
- H. Lower Prism.
- J. Object Glass.
- K. Eyepiece.
- L. Eyeguard.
- M. Diaphragm.
- N. Reader Bracket.
- O. Upper Prism Mount.
- P. Centre Prism Mount.
- Q. Lower Prism Mount.
- R. Worm Spindle, Upper Prism Holder.
- S. Worm Spindle, Worm Wheel Bracket.
- T. Micrometer Head.
- U. Crosshead.
- V. Plug supporting Pillar.
- W. Coned Seating.
- X. Projection.
- Y. Centre Prism Holder.
- Z, Z1, Z2. Bevel Wheels.
- A1. Upper Prism Holder Diaphragm Plate.
- B1. Upper Prism Holder Hinge Piece.
- C1. Upper Prism Holder Shutter.
- D1. Upper Prism Holder Retaining Spring.

CARRIER, N° 7, DIAL SIGHT N° 6, MARK I.

with N° 7 Dial Sight in position.

— Scale $\frac{1}{5}$ —



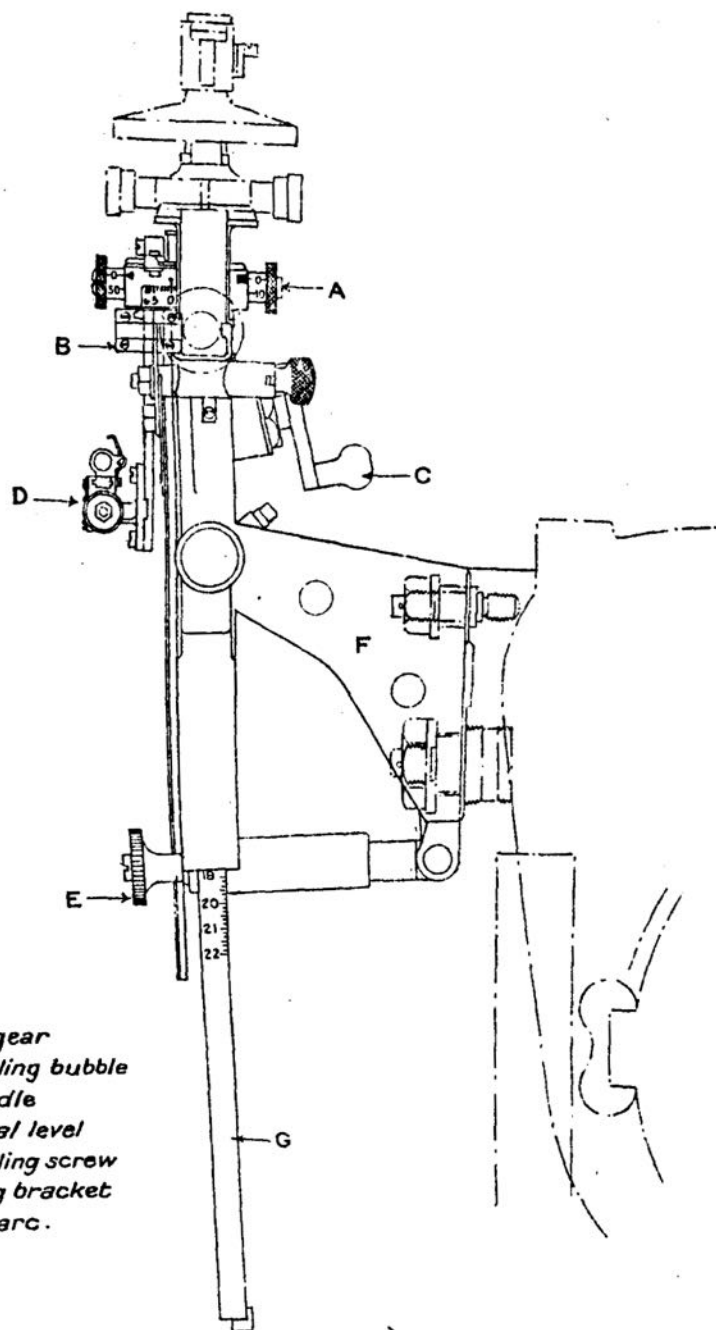
M.V. CORRECTION SCALE
(For future manufacture)

- A. Sight socket bracket
- B. Deflection bracket
- C. M.V. Correction scale
- D. Longitudinal level
- E. Degree scale
- F. Reader bar degree and M.V. scale
- G. Elevating scale

CARRIER, N° 7, DIAL SIGHT N° 6, MARK I.

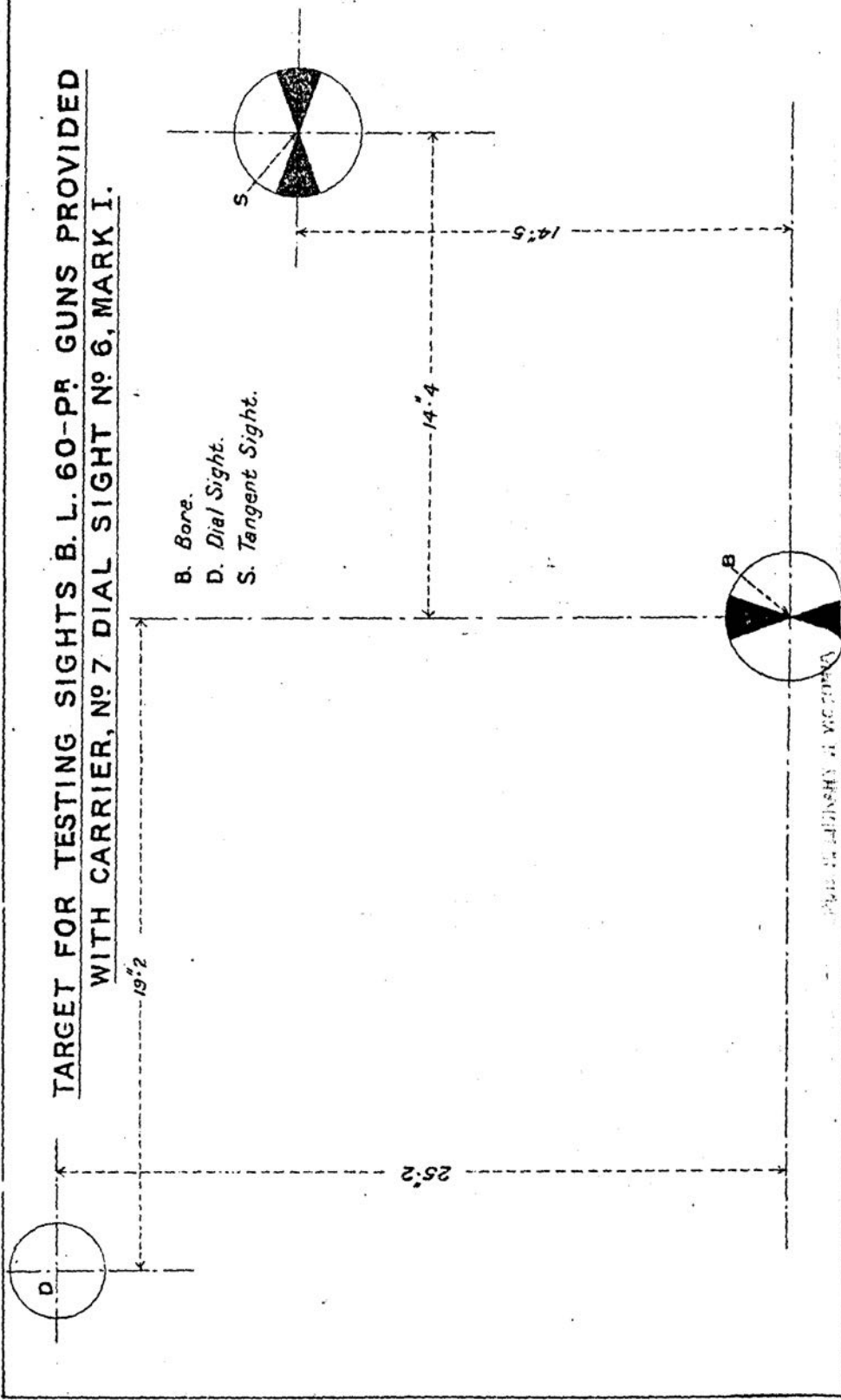
Rear View.

— Scale $\frac{1}{5}$. —



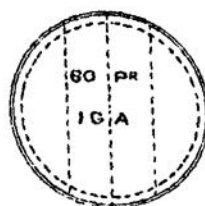
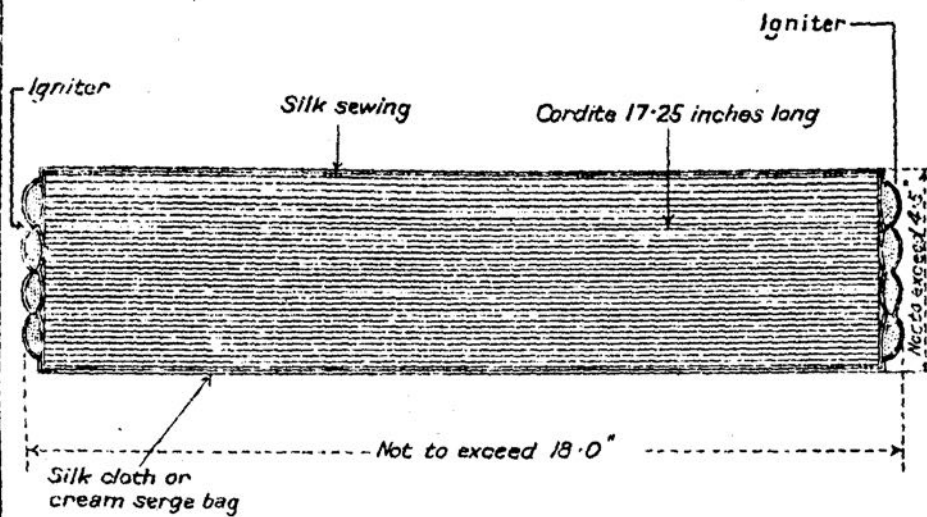
- A. Deflection gear
- B. Cross-levelling bubble
- C. Range handle
- D. Longitudinal level
- E. Cross-levelling screw
- F. Supporting bracket
- G. Elevating arc.

**TARGET FOR TESTING SIGHTS B. L. 60-PR GUNS PROVIDED
WITH CARRIER, N° 7 DIAL SIGHT N° 6, MARK I.**



CARTRIDGE, B.L. 60-PR 9 LB 7 OZS. CORDITE M.D.
OR R.D.B. SIZE 15, MARK III.

SCALE $\frac{1}{4}$

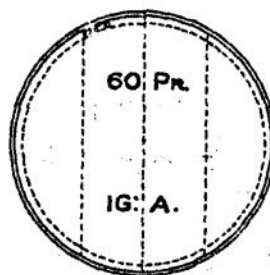
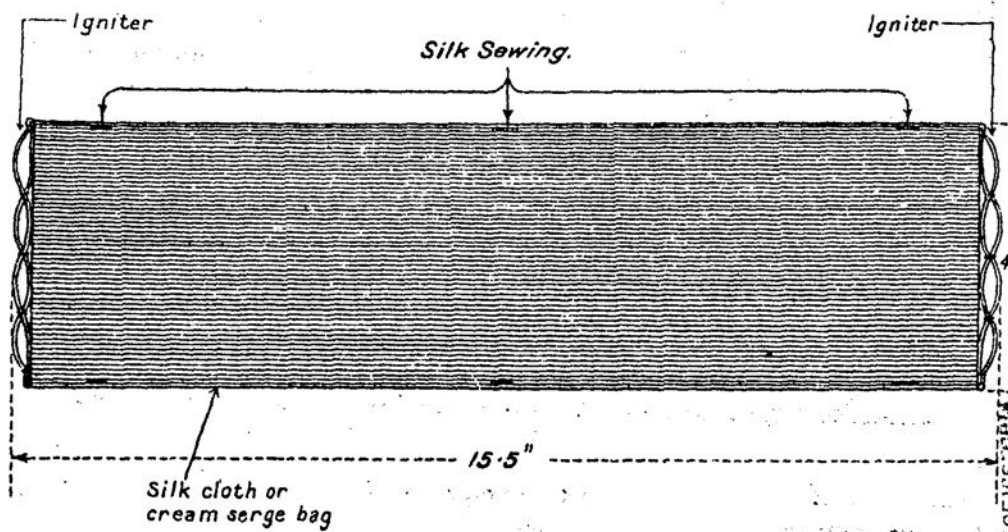


END VIEW

CARTRIDGE B.L. 60-PR. 6 LB. 6 OZ.
CORDITE M.D. OR R.D.B. SIZE II MARK I.

Scale = $\frac{1}{3}$.

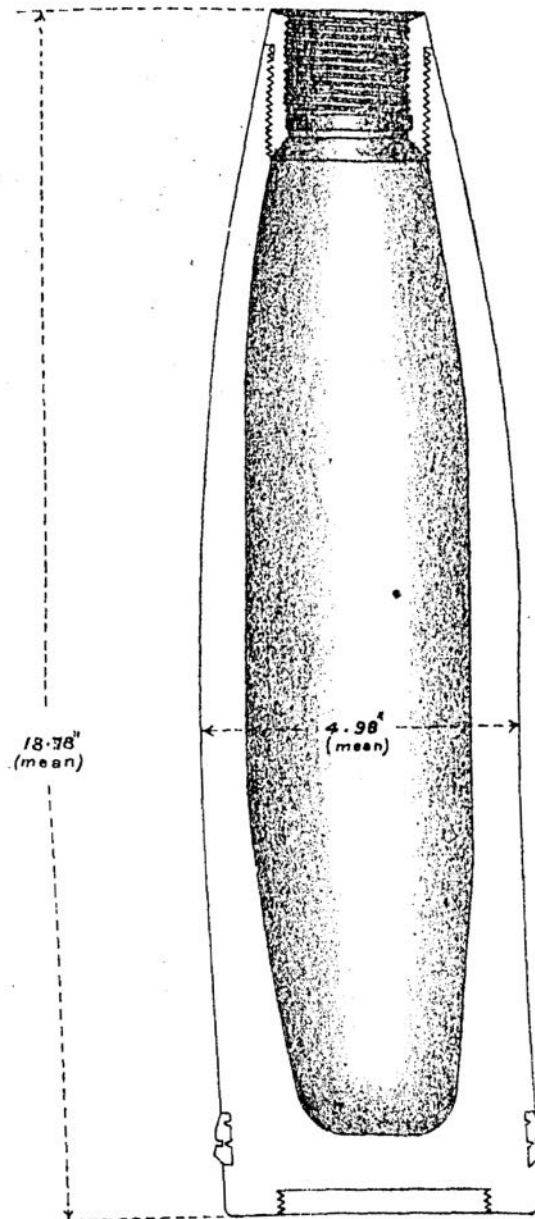
(REDUCED CHARGE)



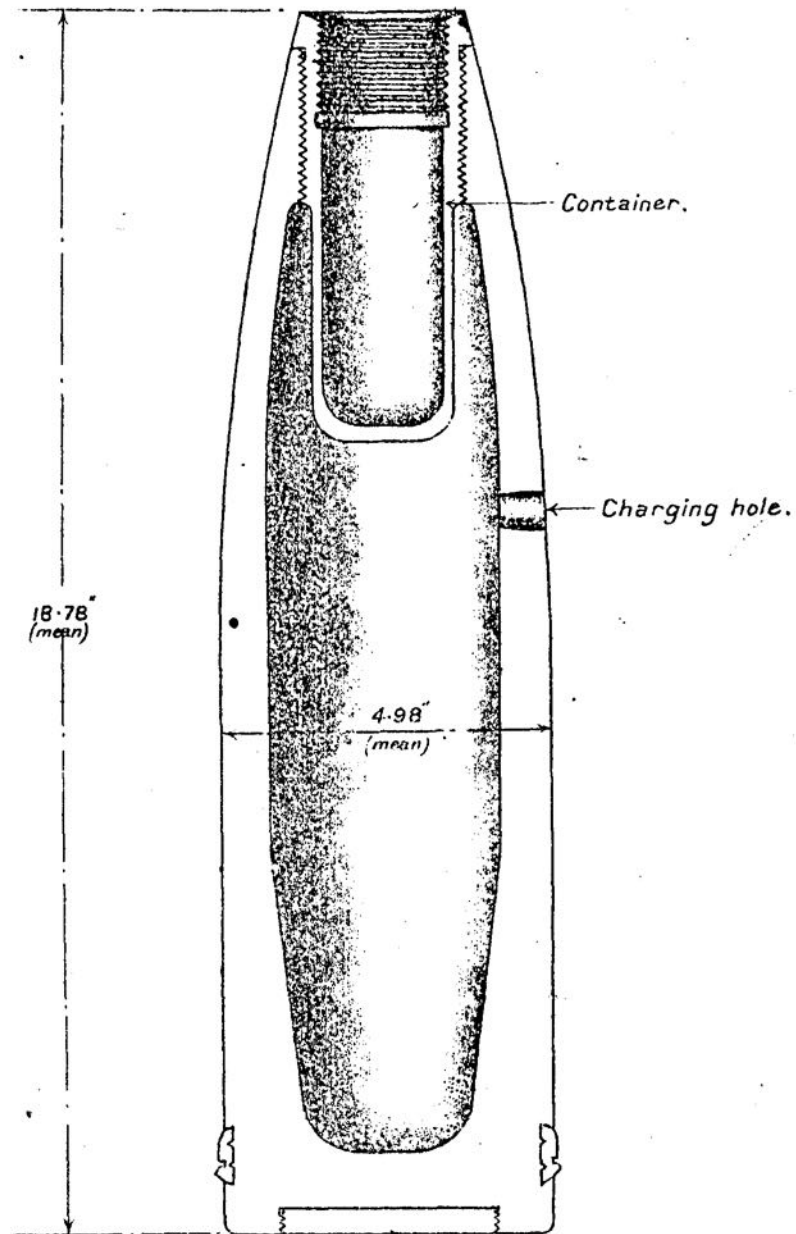
END VIEW.

SHELL, B. L., HIGH EXPLOSIVE, 60-PR MARK IX C.

SCALE - $\frac{1}{3}$.

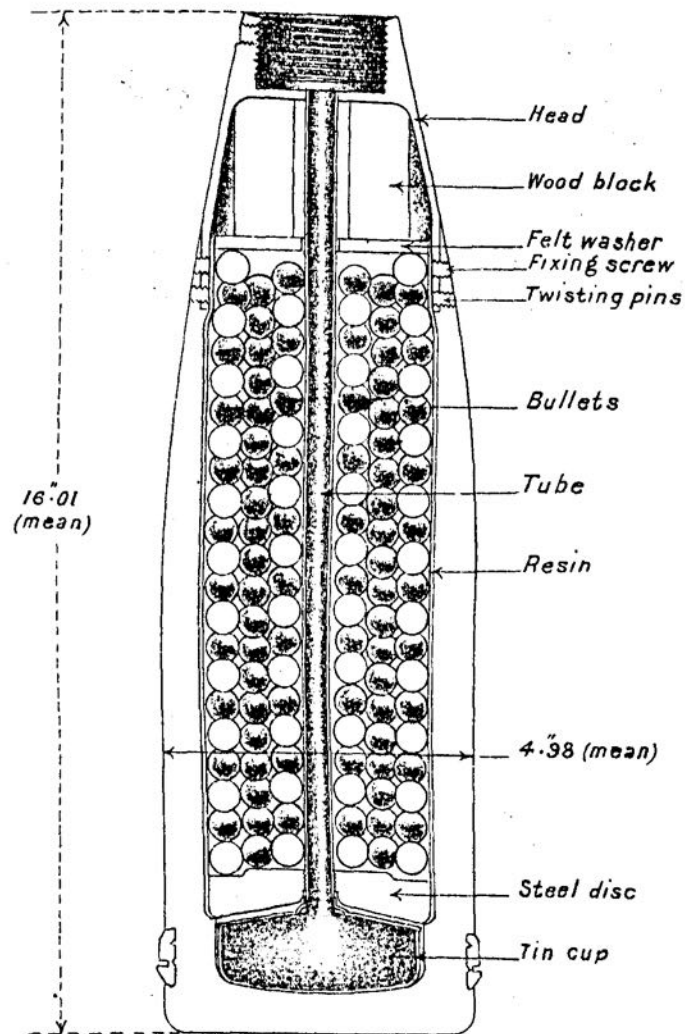


SHELL, B.L., GAS, 60-PR, MARK V C.



SHELL, B. L. SHRAPNEL, 60-PR, MARK IV C.

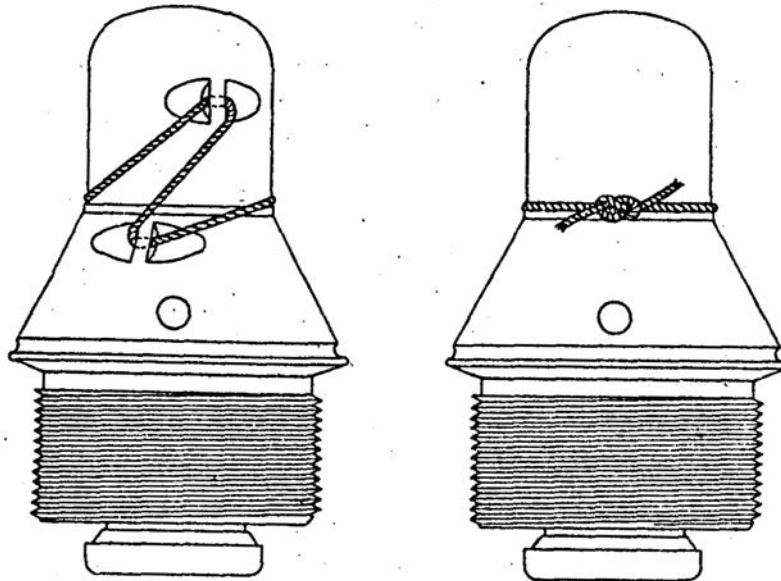
SCALE $\frac{1}{3}$.



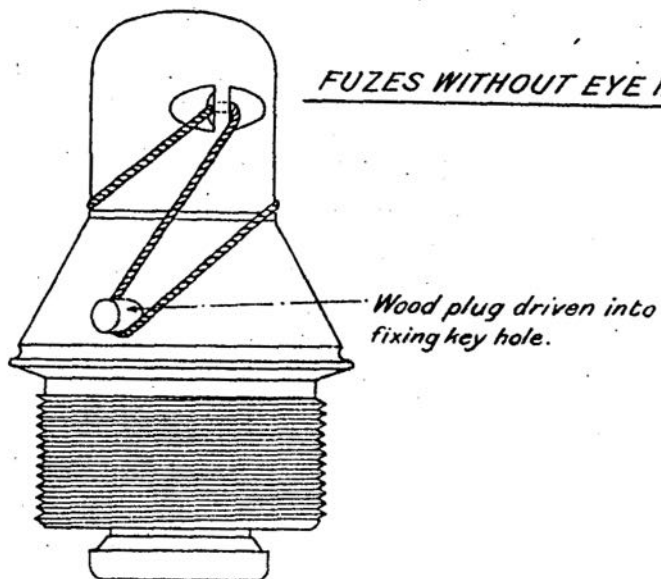
FUZES, PERCUSSION. D. A. N^os. 106 AND 106^E

METHOD OF SECURING CAP WITH CORD.

FUZES WITH EYE FORMED IN BODY.



FUZES WITHOUT EYE IN BODY.



FUZE, PERCUSSION, D. A. N. 106 E MARK IV.

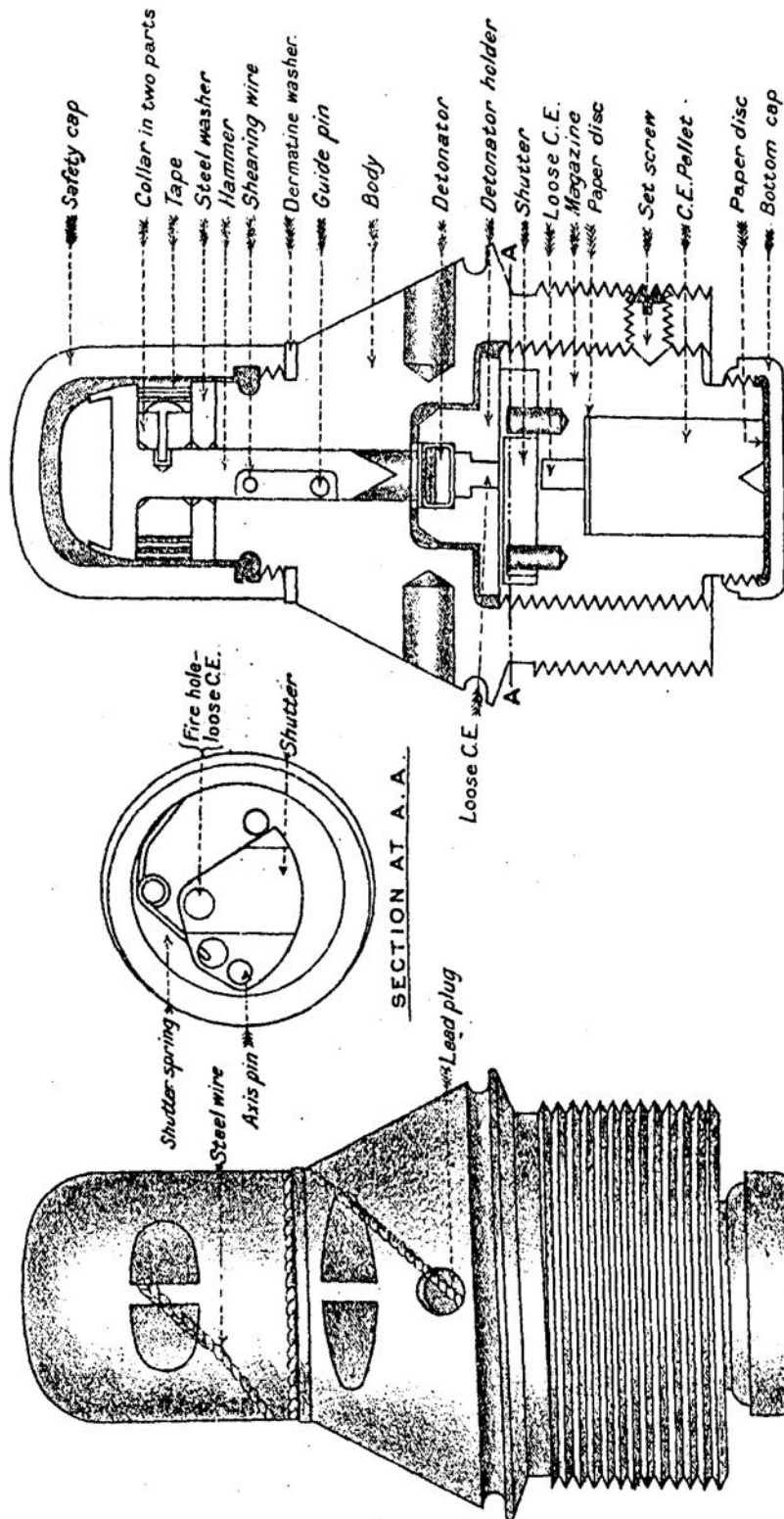
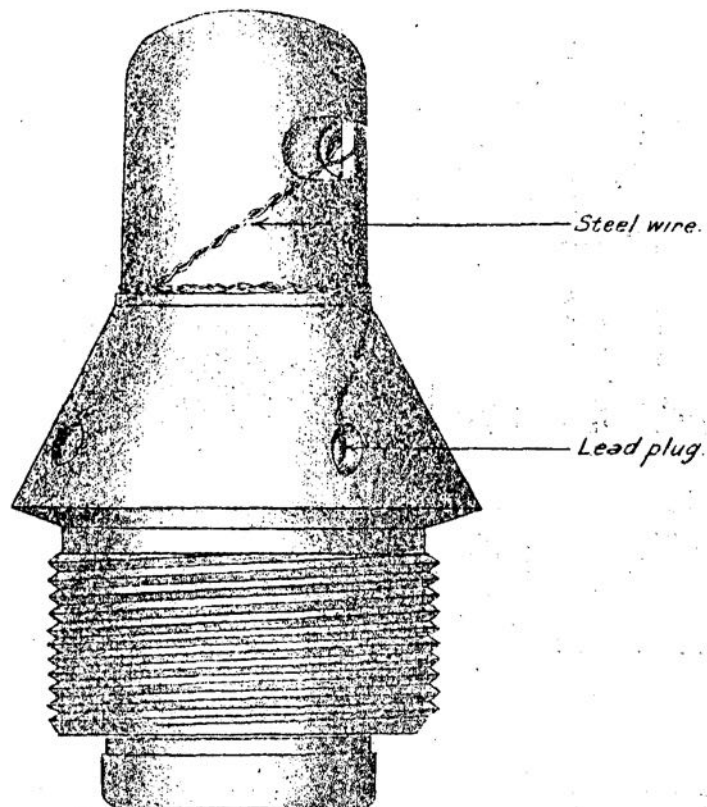
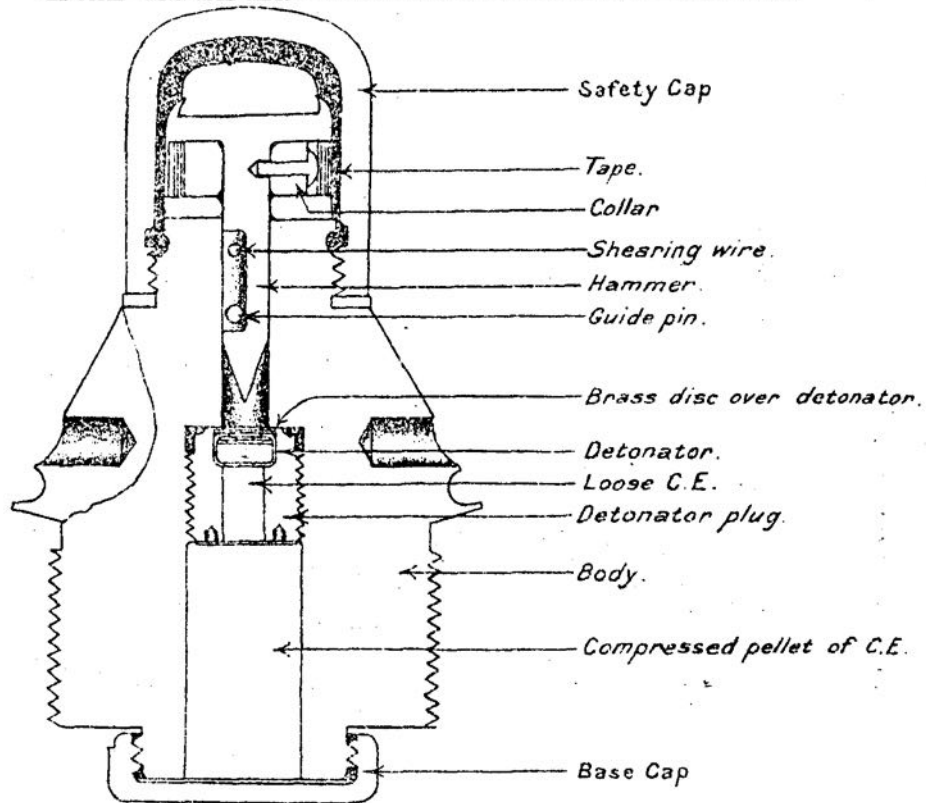


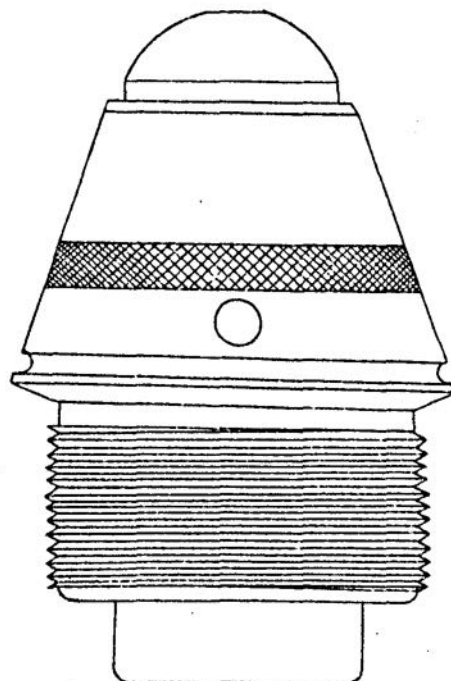
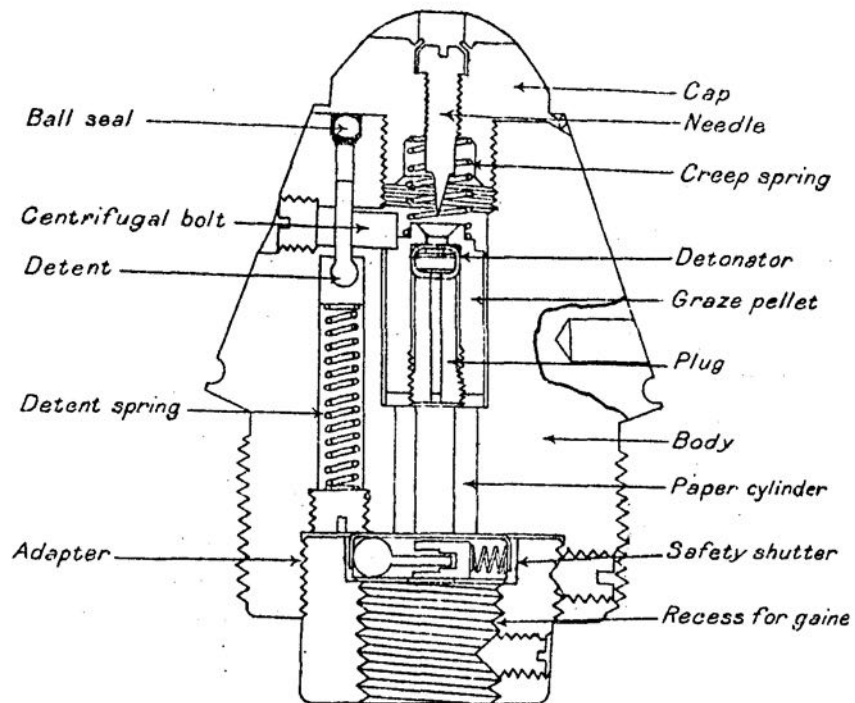
Plate *XXX*

FUZE PERCUSSION, D.A. N° 106. MARK V.



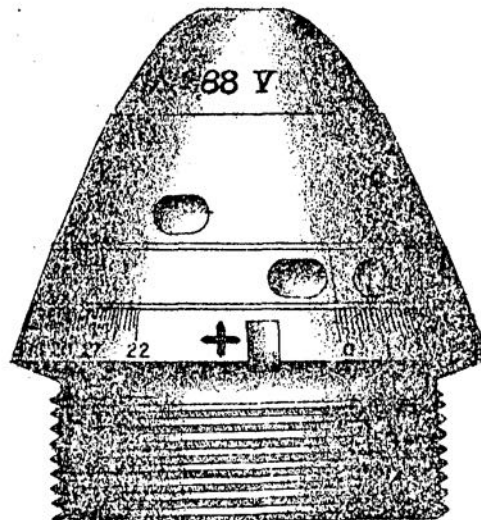
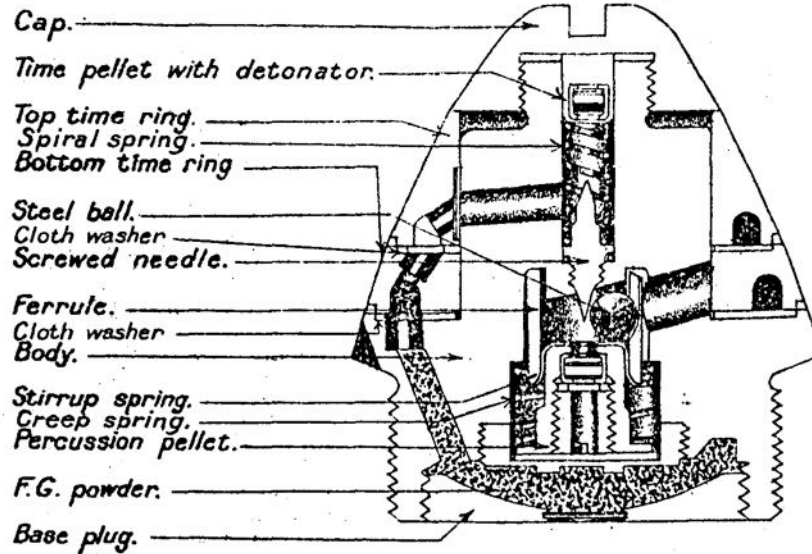
FUZE, PERCUSSION, N° 101 E, MARK II.

SCALE FULL SIZE.



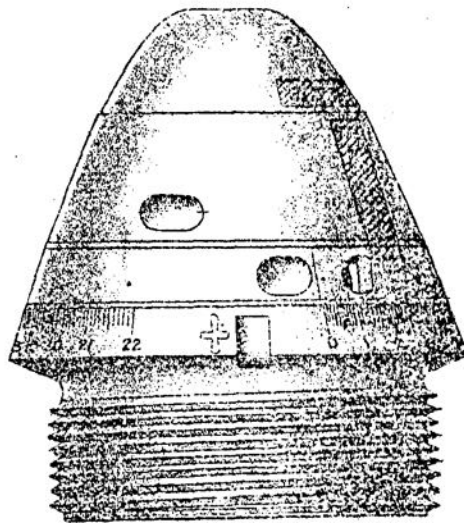
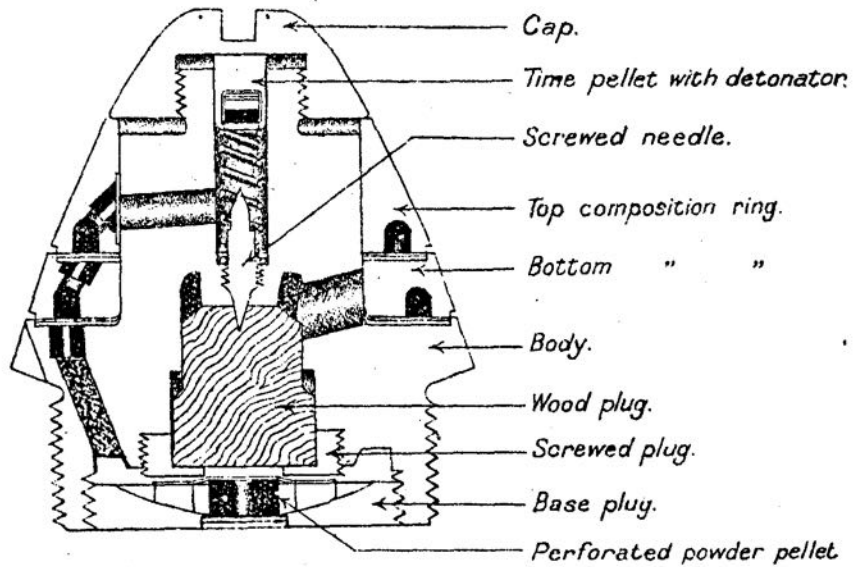
FUZE. TIME & PERCUSSION. Nº88 MARK V.

Scale = $\frac{1}{16}$.



FUZE, TIME, №188 M. MARK V.

FULL SIZE.



TUBE, PERCUSSION, S.A. CARTRIDGE, MARK I.

SCALE $\frac{2}{1}$.

